Volume 26 NOVEMBER, 1952 Number 6

JOURNAL OF PALEONTOLOGY

A publication of The Society of Economic Paleontologists and Mineralogists *and* The Paleontological Society *with the generous support and cooperation of* The American Association of Petroleum Geologists *and* The Geological Society of America

OF MICHIGAN
JAN 7 1953
MUSEUMS LIBRARY

CONTENTS

Aquitanian-Burdigalian diatom deposits of the North Betic strait, Spain . . *G. Colom* 867

A classification of Pennsylvanian conodont assemblages . . . . . *F. H. T. Rhodes* 886

Ostracode genus *Cytherideis* and its allies . . . . . *Harbans S. Puri* 902

Praeammoastuta, new foraminiferal genus of the Venezuelan Tertiary, with an emendation of *Ammoastuta* Cushman and Brönnimann . . . . . *J. G. Bursch* 915

Ostracodes from the Pottsville series in Ohio . . . . . *Mildred F. Marple* 924

Some Wilcox (Eocene) species of the ostracode genus *Cytherideis* . *Alan H. Cheetham* 941

Endothyroid Foraminifera from the Greenbrier series of northern West Virginia . . . . . *John L. Wray* 946

Bibliography and index to new genera, species and varieties of Foraminifera for the year 1951 . . . . . *Hans E. Thalmann* 953

PALEONTOLOGICAL NOTES 993

SOCIETY RECORDS AND ACTIVITIES 1001

NOTICES 1002

INDEX 1005

EDITORS

GROVER E. MURRAY and L. J. WILBERT, JR., for The Society of Economic Paleontologists and Mineralogists.

A. SCOTT WARTHIN, JR., for The Paleontological Society.

THE JOURNAL OF PALEONTOLOGY is published bi-monthly. The numbers issued in January, May, and September are sponsored by The Paleontological Society in Cooperation with The Geological Society of America; those issued in March, July, and November are sponsored by The Society of Economic Paleontologists and Mineralogists in cooperation with The American Association of Petroleum Geologists.

The subscription price of the JOURNAL OF PALEONTOLOGY is $10.00 per year prepaid to addresses in the United States.

Single numbers, $2.00 each to nonmembers, $1.50 to members.

Postage is charged extra for all other countries in the Postal Union, 40 cents on annual subscriptions (total $10.40).

THE JOURNAL will furnish reprints at cost. Orders should accompany manuscript.

Communications about the JOURNAL, subscriptions, rates, memberships, change of address, and nonreceipt of preceding numbers should be addressed to Society of Economic Paleontologists and Mineralogists, P. O. Box 979, Tulsa 1, Oklahoma. Claims for nonreceipt of preceding numbers must be sent in within three months of the date of publication in order to be filled gratis. Communications in regard to advertising should be addressed to T. H. Philpott, The Carter Oil Company, P.O. Box 1739, Shreveport, La.

Communications in regard to manuscripts or purely editorial matters should be addressed to Grover E. Murray or L. J. Wilbert, Jr., School of Geology, Louisiana State University, Baton Rouge 3, Louisiana or to A. Scott Warthin, Jr., Vassar College, Poughkeepsie, N.Y.

Contributors are requested to instruct their photographers to illuminate fossils from the upper left side, the conventional manner. Plates normally should be arranged for publication at the size of 5⅛ by 7⅛ inches, exclusive of margins, heading, and title. Printed numerals of standard size and form may be obtained free from either editor. When requesting them state number of plates and the dimensions of each plate.

A statement of style, form and procedure for the JOURNAL, published in Volume 25, no. 5, is available in reprint form on request to either editor.

Entered as second-class matter at the Post Office at Tulsa 1, Oklahoma, under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in paragraph 4, section 538, P. L. and R. authorized April 3, 1935.

Additional entry as second-class matter at the Post Office at Menasha, Wis.

Printed in U.S.A.

GEORGE BANTA PUBLISHING COMPANY, MENASHA, WIS.

ANNUAL AWARDS FOR OUTSTANDING PAPERS IN THE JOURNAL OF PALEONTOLOGY AND THE JOURNAL OF SEDIMENTARY PETROLOGY

The Society of Economic Paleontologists and Mineralogists is establishing annual awards, one for the outstanding paper in the Journal of Paleontology, and one for the outstanding paper in the Journal of Sedimentary Petrology. The awards will be in the form of a scroll of commendation. It is believed that these awards will encourage research in the fields of interest to Society members by providing a concrete record of achievement. No limitation is placed on the age or society affiliations of the recipients. The awards will be granted for papers published during the second prior year to the year of award. This will provide ample time for assessing the value of a contribution; the two awards to be granted at the 1953 annual meeting at Houston will cover the issues published in 1951.

The members of the Society are the best judges of the quality of contributions in their fields, so the sole basis for awards will be voting by the membership. Each member and associate member of the Society is entitled to one ballot for each Journal; however, because ballots are made available only by publication in the Journals, voting will be determined by the number of Journals to which the member or associate member subscribes. The Research Committee will count the ballots.

The significance and importance of the awards will depend on the response of the members of the Society. Your ballot will focus attention on the paper and the field of research which you believe to be most valuable and promising. The awards will encourage and may facilitate further research by the recipients in particular and also by the Society as a whole.

The ballot printed below should be detached and used only by members and associate members of S.E.P.M. The voters membership in the Society must be proved by his signature, but his identity will be kept confidential by the Research Committee. To count in the results, all ballots must be received by February 15, 1953. Results of the balloting will serve as a partial guide for the editors as to the future content of the Journals.

The outstanding paper published in the Journal of Paleontology in 1951 is _____

_____

by _____. I recommend it for the annual award of the SEPM.

(Signed) _____
Member or Associate Member SEPM

Mail this ballot to Henry W. Menard, Jr., Research Committee, SEPM, U. S. Navy Electronics Laboratory, San Diego 52, California.

JOURNAL OF PALEONTOLOGY

A publication of THE SOCIETY OF ECONOMIC PALEONTOLOGISTS AND MINERALOGISTS *and* THE PALEONTOLOGICAL SOCIETY *with the generous support and cooperation of* THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS *and* THE GEOLOGICAL SOCIETY OF AMERICA

VOLUME 26 NOVEMBER, 1952 NUMBER 6

AQUITANIAN-BURDIGALIAN DIATOM DEPOSITS OF THE NORTH BETIC STRAIT, SPAIN

G. COLOM

"Lucas Mallada" Institute for Geological Research, Madrid, Spain

ABSTRACT—Diatom deposits in the south of Spain, called *moronitas* by Spanish geologists, have been known since the latter part of the last century. They are restricted to the upper Oligocene to the Burdigalian. More than 500 species have been cited; however, the history of their sedimentation has been unknown until recently.

Studies of various geologists, including the author, have revealed a more precise knowledge of Aquitanian-Burdigalian sedimentation in the vicinity of the North Betic strait and a more complete understanding of the sedimentary cycle that gave origin to the marly beds rich in diatoms, Radiolaria, and sponge spicules. This cycle terminated in Spain with the phase of post-Burdigalian foldings that formed the Sierras Beticas (Spanish Alps) and closed the North Betic strait, but continued in North Africa (Algiers, Oran) during the upper Miocene. Transgressive upper Miocene (Vindobonian) sediments now occupy certain inner basins of the Sierras Beticas and occur widely in the Betic valley.

The broad extent of the diatom deposits in southern Spain reveals hitherto unsuspected importance and indicates relations and connections with analogous formations of the Alpine zone to the east and of the Caribbean zone to the west.

INTRODUCTION AND HISTORICAL SUMMARY

IN THE latter part of the 19th century, samples of diatomaceous rocks from an outcrop in the Andalusian zone of Spain, near the town of Morón in the province of Seville, first drew the attention of diatomologists. The great number of species and the excellent preservation of their frustules resulted in comparison of these sediments to such famous deposits as those of Oamaru (New Zealand) and Jeremias (Haiti).

Professor Calderon of the University of Seville and the botanist, Señor Paul, in joint studies published in 1886, confirmed the abundance of diatoms in the marly beds of the upper Tertiary of Andalusia and named the sediments *moronitas*, a derivative of Morón.

Later, much more detailed and thorough research on the micropaleontology of the Morón outcrop by Calderon's pupil, M. Cala (1897), showed that these beds also contain an abundance of other siliceous organisms including silicoflagellates, Ebriaceae, and sponge spicules. Only the age of the Andalusian *moronitas* remained uncertain and problematical. Cala considered them upper Eocene.

Further knowledge was gained by the French geologist, Robert Douvillé, Jr. (1906), who studied the structure of the Spanish Alps in the province of Jaen. He

attributed the purest facies of *Globigerina* marls, with strata of diatoms and Radiolaria, to bathyal deposition during the Aquitanian-Burdigalian.

In 1911, the Spanish diatomologist, Professor Azpeitia, noted the occurrence of numerous other similar deposits in the Andalusian provinces of Cordova and Jaen. His studies demonstrated the importance of these formations throughout the eastern part of the Betic valley.

Summarily, when I commenced research, the *moronitas* appeared to be localized in the zone of Andalusia, within the area of the Betic valley, and were considered to be either Aquitanian or Burdigalian.

Analysis of large quantities of Tertiary sediments collected by Professor Darder in the eastern zone of the Iberian peninsula (Murcia, Alicante, southern Valencia, etc.) verified the frequent occurrence there of marls rich in diatoms and Radiolaria, true *moronitas*, such as those in the Betic valley.

At the same time studies of sediments in the Balearic Islands revealed that marly Burdigalian deposits of Ibiza and of Majorca contained strata similar in composition to those in the provinces of Alicante, Jaen, Cordova, and Seville. Additional investigations in 1930, in the laboratory of Professor J. de Lapparent in Strassbourg, verified deposits sampled by Professor Roman from the French department of Gard as typical *moronitas*. Roman (personal communication, 1931) attributed them to fresh-water origin.

The discovery of a lower Miocene marine deposit at St. Laurent-la-Vernède (Gard), rich in diatoms, Radiolaria, Ebriaceae, etc., was noted by de Lapparent and Hovasse (1934). The diatomologist Lefebure (1935) gave a first list of species from the new French deposit; the greater part of them are common in the Spanish *moronitas*.

In 1938 the French geologist Robaux published his studies on the white marls of Sanlucar de Barrameda (province of Cadiz). Although ignorant of Azpeitia's studies on the Spanish diatoms, Robaux foresaw the possible affinities between the Aquitanian *moronitas* of Andalusia, which he had studied in the province of Cadiz; the earlier-known ones from the provinces of Seville and Jaen; and those of the French department of Gard. However, a hiatus of many kilometers separates the most easterly Spanish *moronitas* in the zone of Jaen from their equivalents at St. Laurent-la-Vernède, and Robaux believed this indicated the nonexistence at that moment of the so-called North Betic strait in front of the Sierra Nevada. On the other hand, the existence of this strait during the lower Neogene is admitted by many geologists.

DISTRIBUTION AND STRATIGRAPHY

The discovery of true *moronitas* in the provinces of Alicante and southern Valencia and in the Balearic Islands tends to corroborate the general age equivalence of this entire long series of diatomaceous deposits and to show the vast extent of their distribution. Although they are not absolutely isochronous throughout the area of sedimentation of the North Betic strait, they are limited, nevertheless, to fluctuations within the Aquitanian and Burdigalian. Moreover, to the east during these same times, similar formations accumulated in the Rhone basin more or less throughout the time of deposition of the marine Alpine formation and eventually formed a continuous link with the deposits of Moravia and of the Roumanian Carpathians. To the west the *moronitas* of the North Betic strait undoubtedly connected with their equivalent-age deposits of Central America, Haiti, Barbados, and similar areas.

Rich diatom deposits are also found to the south, in North Africa (Morocco, Algiers, etc.). The *tripolis* of North Africa, however, do not coincide in age with their Spanish equivalents of the North Betic strait, but seem to be confined to the highest facies of the upper Miocene.

The study of the Spanish *moronitas* is intimately related to the geology of the North Betic strait, a wide marine communication that connected the Mediterranean and Atlantic zones respectively south and north of the Paleozoic Iberian meseta and Betic massifs (figs. 1 and 2). An understanding of the development of the North Betic strait necessitates knowledge of the structural development of the Spanish Alps from the first stages of orogenic efforts to the final paroxysm of tangential movements that gave origin to the Sierras Beticas, after the post-Burdigalian contractions (fig. 3) that

definitely closed the strait. The final stage witnessed the appearance of the Alpine mountain systems of the whole Betic-Rif arch (fig. 3). From a stratigraphical point of view, *moronitas* form part of the Aquitanian-Burdigalian sedimentation that extended widely through the area of the North Betic strait.

FIG. 1—North Betic strait during the Aquitanian. 1. Paleozoic Iberian massif. 2. Other emerged zones. 3. Aquitanian sea and diatom deposits (black dots).

According to our studies thus far, the Aquitanian concords with other lower Oligocene deposits in some localities; it is also found transgressive over earlier sediments (e.g., Triassic and Cretaceous). Similar relationships exist between the Burdigalian and adjacent strata. That is to say, it may concord with the Aquitanian or it may be transgressive over vaster areas. In southern France the great lower Miocene transgression began with the Aquitanian, but, as in Spain, it was overlapped later by the Burdigalian sea, whose advancing waters formed well-developed basal conglomerates over wide areas.

In the North Betic strait, variations between concordant and transgressive sedimentation during the Aquitanian and Burdigalian are relatable in great part to the diastrophic movements that occurred during the accumulation of the deposits. Without going into details, some students of the Sierras Beticas consider that the thrusting of the Alpujarridos took place after the Eocene and before the end of the Oligocene. The thrusting of the decken of Malaga are pre-Burdigalian and in other regions the dislocations of Alpine type did not come to an end until after the Burdigalian had elapsed. According to Professor Paul Fallot, this last phase of the Andalusian orogenic paroxysm is widely extended in the area of the Sierras Beticas.

It would appear, however, that such incidents were not intense enough to alter the monotonous depositional conditions of the *moronitas*, widely diffused as they were throughout the Aquitanian-Burdigalian deposits. Their uniform composition varies only slightly. In a general way, then, as the *Globigerina* muds and the beds of *moronitas* that always accompany them were deposited, they were subjected to a long series of tectonic variations, directly influencing their sedimentation.

It has not been possible, up to the present moment, to distinguish any well-defined stratigraphic subdivisions throughout the deposits, owing to the ambiguity resulting from the various biocoenoses of *Pecten*, *Chlamys*, equinids, etc. Their biostratographic importance is great but is of little

tions were considered neritic by previous authors. On the other hand, when a *Globigerina* regime predominates in a locality, as often happens, the formation was considered bathyal. Recently observed data suggest somewhat different explanations.

There has been much discussion as to the

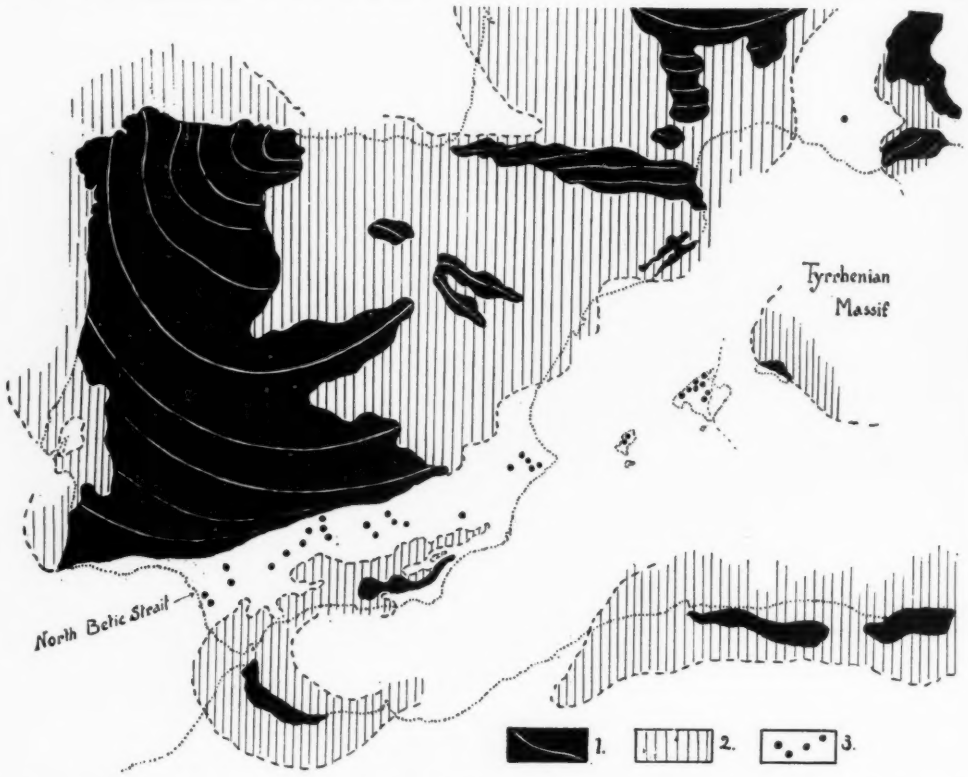


FIG. 2—North Betic strait during the Burdigalian. 1 and 2. Emerged zones, Paleozoic in black. 3. Burdigalian sea and diatom deposits from Jerez de la Frontera (Cadiz) to St. Laurent-la-Vernéde on the east.

efficacy in long-distance correlation.

Andalusian or Alicantine strata containing *Lepidocyclina* have been considered Aquitanian up to now, as have the strata of *moronitas* that accompany them. But a thorough study of *Lepidocyclina* in Spain is yet to be made, and it is possible that certain species may equally reach to Burdigalian levels.

In some regions detrital or littoral beds, such as sandstones, limestones with *Melobesia*, and zoogenous limestones, are intercalated among the *moronitas*. Such formage of the *moronitas* and their possible localization in Aquitanian strata alone. Some authors consider them Aquitanian when they contain *Lepidocyclina*, but it has been proved that part of them are Burdigalian also, in certain Andalusian and Alicantine outcrops in which characteristic macrofossils have been found. Recent studies by Professor J. Roger of the National Museum of Natural History of Paris (personal communication, 1951) on different species of the genus *Pecten* found in the Balearics have confirmed that Aquitanian strata do

not exist in the islands; their marls, nevertheless, are rich in typical *moronitas*. Undoubtedly then, the *moronitas* of Spain do not all belong to the same period. Their time of formation extended from the upper Oligocene or Aquitanian to the Burdigalian, inclusive. They retained, however, the same micropaleontological and sedimentary characters in both ages; that is to say, a littoral facies containing terrigenous elements, and also, from time to time, large quantities of pelagic organisms (Radiolaria and *Globigerina*).

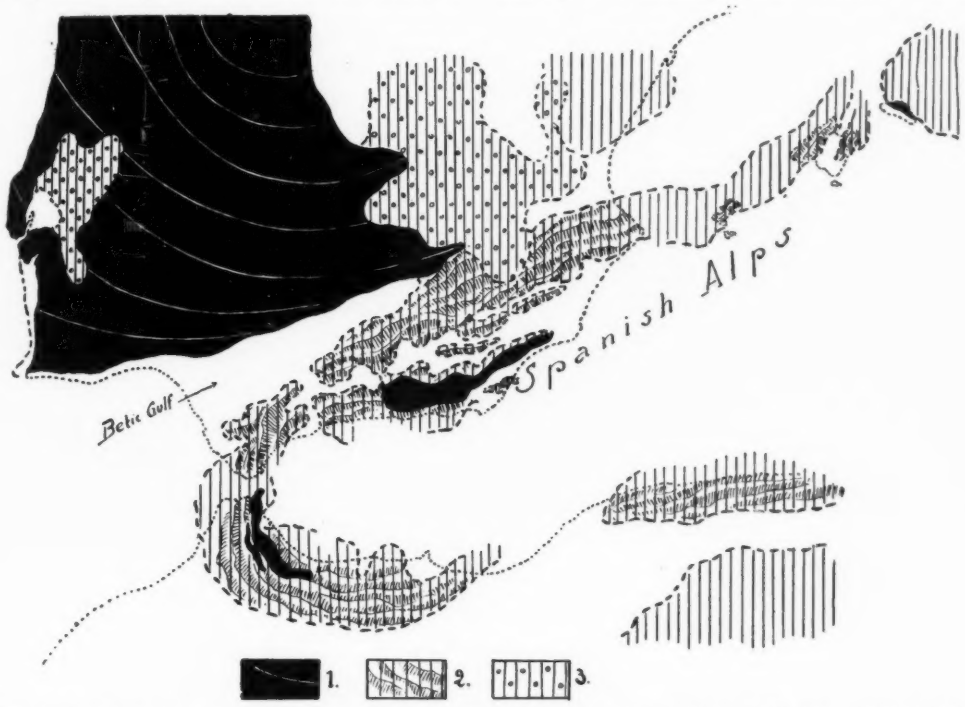


FIG. 3—Southern part of the Iberian peninsula after the final phase of Alpine foldings resulting in the formation of the mountainous Betic-Rif arch and the disappearance of the North Betic strait. 1. Iberian meseta, 2. Spanish Alps (Betic-Rif-Balearic arch). 3. Continental Miocene facies.

During the Aquitanian, *moronitas* were formed in the Atlantic portion of the North Betic strait (fig. 1). There is still doubt as to whether they formed at the same time in the east (Alicante), so that the Atlantic and Mediterranean Aquitanian zones were coextensive, or whether, instead, the continuity of both deposits was broken in the central portion of the strait. In the latter case, the existence of a long strait at that moment cannot be demonstrated.

According to my studies, the union of the two zones was complete during the uppermost Aquitanian. On the other hand, there is no positive proof of the presence of the Aquitanian in the Balearic Islands. Evidence of tangential movements of the Savic phase (upper Oligocene) in Majorca, at least in the southern part of the island, suggests that the Balearic area was emergent in great part during this period. The great Burdigalian transgression occurred over land only recently subjected to the tangential contractions which preceded the stronger post-Burdigalian ones that gave origin to the present structure of the islands.

The discrepant opinions among geologists as to whether the Aquitanian represents the final phase of the Oligocene or only the base of the Burdigalian will not be considered here. Deposits of both periods occur in the southern Iberian peninsula, in so intimate an association of lithological and faunistic facies that it is better, for lack of more complete and precise data of a paleontologi-

cal nature, to consider them both as forming part of a vast sedimentary province of more than 700 kilometers in extent, from Cadiz to the Balearic Islands, subordinate to a particular paleoceanographic environment and a very uniform sedimentation.

The *moronitas* of the North Betic strait differ in composition from *tripoli*, *Kieselguhr*, etc. and cannot be compared to them. They are simply very fine, whitish or blue-gray marls, in many cases globigerinic, containing a large quantity of loose coccolith discs. Consequently, in some beds the proportion of calcium carbonate is very high. A sample from Majorca (Burdigalian from Muro) was analyzed by Dr. J. Gamundi, as follows:

	per cent
H_2O	1.22
$CaCO_3$	53.23
$MgCO_3$	6.07
NaCl	0.42
Fe_2O_3	3.33
Al_2O_3	10.07
SiO_2	24.72
Organic matter	0.94

Marly materials from other localities have yielded similar analyses. The *moronitas*, then, are *diatom earth* exceedingly rich, in some strata, in tests of siliceous microorganisms. The term *diatom earth* was also adopted by Filipesco for his diatom-bearing rocks from the Roumanian Carpathians. With these preliminaries noted, we will now follow the origin of the *moronitas* and the vicissitudes of their sedimentation across the paleoceanographic medium of the North Betic strait during the course of the Aquitanian and Burdigalian.

The *moronitas* form part of a large ensemble of sediments probably not exceeding 300 meters in thickness. Among these deposits are detrital limestones, zoogenic limestones with *Lepidocyclina* or melobesias, but above all a strong preponderance of variable sandstones, chiefly of a marly type, with abundant beds of quartz. The finer sandstones grade into *Globigerina* ooze and glauconitic and pyritiferous beds. Usually, marly sandstones and *Globigerina* ooze are the predominant sediments.

The sandstones are characterized by the presence of some sort of mineral or organic detritus, resulting in strata composed chiefly of fragments of Bryozoa, melobesias, etc., or solely of clastic elements with a notable predominance of quartz grains. *Amphistegina lessonii* d'Orbigny is frequent in these facies and is accompanied by badly worn "rotaliids" or, in certain localities, by a preponderance of Miliolidae. All of these, but especially the last, indicate shallow waters.

The quartz grains of these sandstones are usually limpid but sometimes they contain minute inclusions of zircon or rutile, generally difficult to specify owing to their smallness. The size of the quartz grains varies in different beds, but they usually range between about 60 and 100 microns in length. They are rather angular, with edges only slightly abraded. They probably were formed by erosive action of the sea upon the coast followed by rapid deposition nearby.

Vertically, the grains of quartz are very irregularly, but constantly, distributed through the deposits and prove the existence of strong currents and successive erosive actions which scattered them over wide marine areas of the strait. Almost all of the siliceous residues obtained from these sandstones contain more or less abraded fragments of tourmaline, zircon, andalusite, rutile, garnets, mica straws, etc. Tourmaline prisms are the most frequent. Most of the minerals were derived from the nearby Paleozoic massifs; some may also have come from younger sedimentary rocks.

The *Globigerina* marls vary perceptibly in composition, besides including intercalations entirely lacking in organic remains. The marly strata of greatest thickness always contain a greater or lesser quantity of globigerinas mixed with different detrital elements; such strata constitute the predominant lithological mass of these muds. Their origin is clearly neritic.

Very compact marly strata, resembling marly sandstones, when studied in thin section, prove to be very pure beds of *Globigerina* (fig. 4). At times these are 100 per cent pure. Their arenaceous appearance is due solely to the innumerable shells of *Globigerina* exposed by superficial erosive action. All intermediate sedimentary types exist between the sandstones and marls.

The globigerinic concentrations of the Aquitanian-Burdigalian formations are the highest in the entire Tertiary of the Iberian

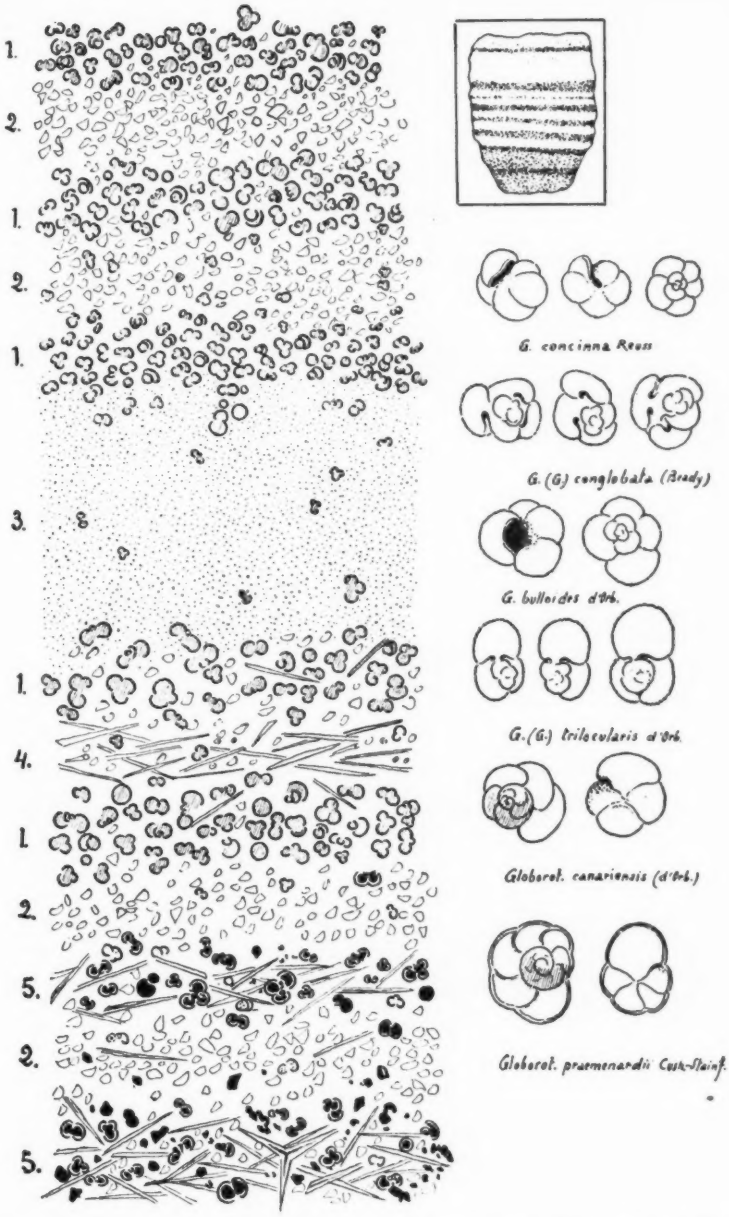


FIG. 4—*Upper right*—Thin section, ×1, of a fragment of a marly sandstone from "Mas de la Penya," Concentaina (province of Alicante), showing the alternation of layers of *Globigerina* (dark portions) with layers of quartz (white portions) and of *moronitas*.

Left—Somewhat schematic drawing of the same fragment, ×7½. 1. Very pure beds of *Globigerina*. 2. Quartz grains. 3. *Moronitas*. 4. Beds rich in sponge spicules. 5. *Globigerina* beds impregnated with pyrite.

Lower right—Principal species of *Globigerina* and *Globorotalia*, ×20, identified from the globigerinic beds.

TABLE 1.—RANGE CHART OF DIATOM SPECIES IN THE NORTH BETIC STRAIT REGIONS

	(Morón) Seville	(Muro) Majorca	Gard, France
Achnantes brevipes Agardh	●		
Actinocyclus ehrenbergii Ralfs	●	●	●
—— —— var. *ralfsii* (W. Smith) Hustedt	●		●
—— —— var. *crassa* (W. Smith) Hustedt	●		●
—— *ellipticus* Grunow	●		
—— *elongatus* Grunow	●		
—— *fasciculatus* Castracane	●		
—— *giennensis* Azpeitia	●	●	
—— *hispanicus* Azpeitia	●		
—— *incertus* Grunow	●		
—— *ingens* Rattray	●		
—— *janischii* Schmidt	●		
—— *moronensis* Deby	●		
—— *ovalis* Norman	●		
—— *peplum* Brun	●		
—— *ralfsii* W. Smith	●		
—— *roperi* (Brebisson) Grunow	●		
—— *sendaianus* Brun	●		
—— *subtilis* (Gregory) Ralfs	●		●
Actinoptychus affinis Grunow	●		
—— *amblyocerus* (Ehrenberg) Schmidt	●	●	
—— *areolatus* Ehrenberg	●		
—— *biformis* Brun	●		
—— *bifrons* Schmidt		●	
—— *boliviensis* Janisch		●	
—— *dilatatus* Pantocsek	●		
—— *elegantulus* Grove and Sturt	●		
—— *ellipticus* Grunow	●		
—— *glabratus* Grunow	●	●	
—— —— var. *incisa* Grunow	●		
—— *grundleri* Schmidt	●	●	
—— *heterostropus* Schmidt		●	
—— *interpositus* Brun	●		
—— *janischi* Grunow	●	●	
—— *moroensis* Greville	●		
—— *octonarius* Ehrenberg	●	●	
—— *simbirskianus* Schmidt		●	
—— *splendens* (Shadbolt) Ralfs	●	●	●
—— —— var. *halionyx* Grunow	●		
—— *stella* Schmidt	●	●	●
—— *subtilis* Schmidt		●	
—— *summisus* Schmidt	●	●	
—— *undulatus* Ehrenberg	●	●	●
—— —— var. *lativana* Schmidt		●	
—— *vulgaris* Schmidt	●	●	
—— —— var. *latinum* Schmidt		●	
—— *wittianus* Ralfs		●	●
Amphora complexa Gregory	●		
—— *crassa* var. *punctata* Grunow	●		
—— *fasciata* Gregory	●		
—— *grundleri* Grunow	●		
—— *robusta* Gregory	●		
—— *sturtii* Grunow, var.	●		
—— *valida* Peragallo	●		
Annellus californicus Tempère	●		

TABLE 1—*Continued*

	(Morón) Seville	(Muro) Majorca	Gard, France
Antelminellia gazellae Janisch	●		
Arachnoidiscus ehrenbergii Bailey	●	●	
—— —— var. *ornatus* Ehrenberg	●		
—— *grevilleanus* Hardman		●	
—— *ornatus* Ehrenberg	●	●	
Asterolampra affinis Greville	●		
—— *dallasiana* Greville	●		
—— *grevillei* (Wallich) Gregory	●	●	●
—— *marylandica* Ehrenberg	●	●	●
—— *moronensis* Greville	●		
—— *rotula* Greville			●
Asteromphalus arachnae Brébisson	●		
—— *grevillei* Wallich	●	●	
—— *moronensis* Greville	●		
—— *shadboltianus* Greville	●		
—— *robustus* Castracane	●		●
Aulacodiscus affinis Grunow		●	
—— *amoenus* Greville	●	●	
—— *angulatus* Greville		●	
—— *catenarius* Witt		●	
—— *chasei* Pantocsek	●		
—— *crux* Ehrenberg		●	
—— *decorus* Greville		●	
—— *dubius* Azpeitia	●		
—— *gamundii* Azpeitia	●		
—— *giganteus* Tempère and Brun		●	
—— *grevilleanus* Norman	●		
—— *margaritaceus* Ralfs		●	
—— *patulus* Grunow		●	
—— *rogersii* (Bailey) Schmidt	●		
—— *scaber* Ralfs		●	
—— *subangulatus* Pantocsek	●	●	●
—— *suspectus* Schmidt	●	●	
—— *thumii* Schmidt		●	
Auliscus caballi Schmidt	●		
—— *coelatus* Bailey	●	●	●
—— —— var. *constricta* Rattray	●		
—— —— var. *major* Schmidt	●		
—— —— var. *mergens* Rattray	●		
—— —— var. *rhipis* Schmidt	●		●
—— —— var. *strigillata* Schmidt	●		●
—— *incertus* Schmidt	●		●
—— *macraenus* ? Greville	●		
—— *moronensis* Greville	●	●	
—— *normanianus* Greville	●	●	
—— *pruinosus* Bailey	●		●
—— —— var. *carpentariae* ? Grunow	●		
—— —— var. *lorcana* Azpeitia	●		
—— *punctatus* Bailey	●		
—— *sculptus* Ehrenberg	●	●	
—— *secalli* Azpeitia	●		
—— *stockhardtii* Janisch	●		
—— *sublaevis* Grunow	●		
Biddulphia antiqua Truan and Witt	●		
—— *aurita* Brébisson	●		

TABLE 1—*Continued*

	(Morón) Seville	(Muro) Majorca	Gard, France
—— *calamus* Tempère and Brun	●		
—— *johnsoniana* Greville	●		
—— *longispina* Grunow	●		
—— *moronensis* Cleve	●	●	
—— *obtusa* Kützing	●		
—— *pulchella* Gray	●	●	●
—— *regina* W. Smith	●	●	●
—— *roperiana* Greville		●	
—— *tridentata* Ehrenberg	●	●	
—— *tuomeyi* Bailey	●	●	●
Brunia mirabilis Brun	●		
Campylodiscus adriaticus Grunow		●	
—— *absoletus* Cleve		●	
—— *clypeus* Ehrenberg		●	
—— *decorus* Brébisson	●		●
—— *ecclesianus* Greville	●	●	
—— *eximius* Gregory	●		
—— *horologium* Williamson	●		●
—— *limbatus* Brébisson	●	●	●
—— *obsoletus* Cleve		●	
—— *stellatiformis* Azpeitia	●		
—— *vermiculatus* Tempère	●		
Campyloneis grevillei (W. Smith) Grunow	●	●	●
—— —— var. *regalis* Cleve	●		
Cerataulus johnsonianus Greville	●		
—— *kinkeri* Schmidt	●		
—— *thumii* Schmidt	●		
—— *turgidus* Ehrenberg	●	●	●
—— —— forma *major spinifera*	●		●
Chaetoceras didymus Ehrenberg	●	●	
—— *wighamii* Brightwell	●		
Cladogramma conicum Greville	●		●
Clavicula polymorpha Grunow		●	
—— —— var. *robusta* Brun	●		
Climacosira mirifica W. Smith	●		
Climacosphenia moniligera Ehrenberg		●	
—— *elongata* Bailey	●		●
Cocconeis argus Grunow	●		
—— *andesetica* Pantocsek		●	
—— *calderoni* Azpeitia	●		
—— *decipiens* Cleve	●		
—— *dirupta* Gregory	●		●
—— —— var. *californica* Cleve	●		
—— —— var. *flexella* (Janisch and Rabenhorst) Grunow	●		
—— *distans* Gregory	●		
—— *lorenziana* Grunow	●		
—— *maxima* Grunow	●		
—— *moronensis* Schmidt	●		
—— *oculus-catis* Brun	●	●	
—— *pellucida* Hantzsch		●	
—— *pinnata* Gregory	●		
—— *pseudomarginata* Gregory	●	●	●
—— *regalis* Greville	●		
—— *scutellum* Ehrenberg	●		
—— *sigma* Pantocsek	●	●	
—— *vetusta* Schmidt	●		

TABLE 1—*Continued*

	(Morón) Seville	(Muro) Majorca	Gard, France
—— *vitrea* Brun	●	●	
Coscinodiscus aeginensis Schmidt	●	●	
—— *apiculatus* Ehrenberg	●		
—— —— var. *monicae* Grunow	●		
—— —— var. *woodwardi* Rattray	●		
—— *asteroides* Truan and Witt		●	
—— *asteromphalus* Ehrenberg	●	●	●
—— —— var. *conspicua* Grunow		●	
—— *biangulatus* Schmidt	●		
—— *biradiatus* Greville	●		
—— *caballeroi* Azpeitia	●		
—— *centralis* Ehrenberg	●		
—— *concavus* Gregory	●	●	
—— *concinnus* W. Smith	●		
—— *crassus* Bailey	●	●	
—— *cribrosus* Truan and Witt	●	●	
—— *curvatulus* Grunow	●	●	
—— —— var. *latius-striata* Schmidt	●	●	
—— —— var. *odontodiscus* (Grunow) Hustedt	●		●
—— *debilis* Greville	●		
—— *denarius* Schmidt	●	●	●
—— *dubius* Rattray	●	●	
—— *echinatus* Rattray	●		
—— *elongatus* Grunow	●		
—— *euryomma* Schmidt	●		
—— *eutychus* Ehrenberg	●		
—— *excentricus* Ehrenberg	●		●
—— —— var. *fasciculatus* Hustedt	●	●	●
—— *fimbriatus* Ehrenberg	●	●	
—— *gigas* Ehrenberg	●		●
—— —— var. *woodwardi* Schmidt	●		
—— *griseus* Greville		●	
—— *heteroporus* Ehrenberg	●		
—— —— var. *moronensis* Grunow	●	●	
—— *inaequisculptus* Rattray	●		
—— *johnsonianus* Greville	●		
—— *lacustris* Grunow	●		
—— *lentiginosus* Janisch	●		
—— *leptopus* Grunow	●		
—— *lewisianus* Greville	●	●	
—— —— var. *moronensis* Rattray	●		
—— *lineatus* Ehrenberg	●	●	●
—— *magnisculptus* Rattray	●		
—— *marginatus* Ehrenberg	●	●	●
—— *marginulatus* Grunow Grunow	●		
—— —— var. *curvato-striata* Grunow	●		
—— *micans* Schmidt	●		
—— *minor* Ehrenberg	●		
—— *moelleri* Schmidt	●		
—— *moronensis* Rattray	●		

TABLE 1—*Continued*

	(Morón) Seville	(Muro) Majorca	Gard, France
—— *naviculoides* Truan and Witt	●	●	
—— *nitidulus* Grunow	●	●	
—— *nitidus* Gregory	●		●
—— —— var. *moronensis* Grunow	●		
—— *nobilis* Grunow	●	●	
—— *nodulifer* Schmidt	●		●
—— *obscurus* Schmidt	●	●	●
—— —— var. *minor* Rattray	●		
—— *obversus* Rattray	●		
—— *oculus-iridis* Ehrenberg	●	●	●
—— *odontodiscus* Grunow	●		
—— *omphalanthus* Ehrenberg	●		
—— *ovalis* Greville	●		
—— *perforatus* Ehrenberg	●		
—— —— var. *delicatulus* Rattray	●		
—— *plicatus* Grunow	●		
—— *pulchellus* Greville	●		
—— *radiatus* Ehrenberg	●	●	●
—— *robustus* Greville	●		
—— *rothii* (Ehrenberg) Grunow	●		
—— *scintillans* Greville	●		
—— *stokesianus* Greville	●		
—— *subangulatus* Grunow	●		
—— *sublineatus* Grunow	●		
—— *subtilis* Ehrenberg	●	●	
—— *symbolophorus* Ehrenberg	●		
—— *symmetricus* Greville	●		
—— *temperei* Brun	●		
—— *tuberculatus* Greville	●		
Craspedodiscus coscinodiscus Ehrenberg	●	●	
—— *elegans* Ehrenberg		●	
—— *weissflogii* Pantocsek		●	
Cyclotella sevillana Deby	●		
—— *sexpunctata* Deby	●		
Cymbella lanceolata Ehrenberg		●	
Cymatosira adaroi Azpeitia	●		
—— *lorenziana* Grunow	●		
Denticula nicobarica ? Grunow	●		
Dicladia capreolus Ehrenberg	●	●	
—— *fungairiñoi* Azpeitia	●	●	
Dimerogramma marinum (Gregory) Ralfs	●		
Diploneis beyrichiana Schmidt	●		
—— *bombus* Ehrenberg	●	●	●
—— —— var. *kuntzingii* Grunow	●		
—— *crabro* Ehrenberg var. *nitida* Peragallo	●		
—— *gemmata* Greville	●	●	
—— —— var. *pristiophora* Janisch	●	●	
—— *gemmatula* (Grunow) Cleve	●	●	
—— —— var. *hungarica* Cleve	●	●	
—— *smithi* Brébisson	●	●	●
—— *subcincta* Schmidt	●		
Donkinia recta Grunow	●		

TABLE 1—*Continued*

	(Morón) Seville	(Muro) Majorca	Gard, France
Dossetia temperei Azpeitia		●	
Endyctia oceanica Ehrenberg	●		●
—— *schmidti* Pantocsek	●		
Entogonia punctata Ehrenberg		●	
—— *gratiosa* Greville		●	
Entopyla australis Ehrenberg	●	●	
—— *incurvata* (Arnott) Grunow	●	●	
Ethmodiscus oruetaei Azpeitia	●		
—— *rossicus* Pantocsek		●	
Euodia caballeroi Azpeitia	●		
—— *gibba* Bailey	●	●	
—— —— var. *moronensis* Tempère and Peragallo	●		
—— *janischii* Grunow	●	●	
—— *subrotundata* Azpeitia	●		
—— *ventricosa* Castracane	●		
Eupodiscus argus Ehrenberg		●	
—— *radiatus* Ehrenberg		●	
Fragilaria ischaboensis Grunow	●		
—— *pliocena* Brun	●		
Gephyria gigantea Greville	●		●
—— *media* Arnott	●	●	
—— *rodriguezi* Azpeitia	●		
Goniothecium odontella Ehrenberg	●	●	
—— *rogersii* Ehrenberg	●		
Grammatophora africana Ehrenberg	●		
—— *marina* Kützing	●		
—— —— var. *gibba* Grunow	●		
—— *moronensis* Greville	●		
—— *oceanica* Ehrenberg	●	●	●
—— *parallela* Ehrenberg	●		
—— *robusta* Dippel	●	●	●
—— *serpentina* Ehrenberg	●		
Gyrodiscus hungaricus Pantocsek	●		
Hemiaulus antarcticus ? Ehrenberg	●		
—— *polycistinum* Ehrenberg		●	
—— *sibericus* Grunow	●		
Hemidiscus cuneiformis Wallich			●
—— —— var. *ventricosa* (Castracane)	●		●
—— —— var. *gibba* (Bailey) Hustedt	●		●
Hercotheca caput-medusae Azpeitia	●		
—— *mammillaris* Ehrenberg	●		
Hyalodiscus laevis Ehrenberg		●	
—— *pauli* Azpeitia	●		
—— *radiatus* Bailey	●		●
—— *stelliger* Bailey	●		
—— *subtilis* Bailey	●		
Isthmia capensis Grunow	●		
—— *enervis* Ehrenberg	●	●	●
—— *nervosa* Kützing	●		
—— *szaboi* Pantocsek		●	
Melosira clavigera Grunow	●	●	●
—— *madagascariensis* Schmidt		●	
—— *sol* Ehrenberg		●	

TABLE 1—*Continued*

	(Morón) Seville	(Muro) Majorca	Gard, France
—— *sulcata* (Ehrenberg) Kützing	●	●	
—— —— var. *coronata* Grunow	●	●	●
—— —— var. *radiata* Grunow	●	●	●
—— —— var. *biseriata* Grunow	●		●
—— *westii* W. Smith	●		
Muelleriella limbata Ehrenberg	●		
Navicula abrupta Greville	●		
—— *apis* Ehrenberg	●	●	
—— *approximata* Greville	●		
—— *arabica* Grunow	●		
—— *aspera* Ehrenberg	●	●	
—— —— var. *intermedia* Grunow	●		
—— *bleischiana* Janisch and Rabenhorst	●		
—— *brasiliensis* Grunow		●	
—— *chersonensis* Grunow	●		
—— *circumsecta* Grunow, var.	●		
—— *clavata* Gregory	●		●
—— —— var. *wrightii* O'Meary	●		
—— *commutata* Grunow		●	
—— *crabro* Ehrenberg	●	●	
—— —— var. *oranensis* Schmidt	●		
—— —— var. *pandura* Brébisson	●		
—— *didyma* Ehrenberg	●		
—— *excavata* Greville		●	
—— *dosseti* Azpeitia	●		
—— *erythraea* Grunow		●	
—— *expedita* Schmidt	●		
—— *exul* Schmidt	●		
—— *fusca* Gregory	●	●	
—— *granulata* Brébisson	●		
—— *grunowi* Rabenhorst var. *moronensis*	●		
—— *haytiana* Truan and Witt		●	
—— *hennedyi* W. Smith	●	●	●
—— —— var. *crassa* Peragallo	●		
—— —— var. *cuneata* Schmidt		●	
—— —— var. *granulata* Grunow	●	●	
—— —— var. *manca* Schmidt		●	
—— *humerosa* Brébisson		●	●
—— *iberica* Azpeitia	●		
—— *interrupta* Kützing	●		
—— *kinkeriana* Truan	●		
—— *lacrymans* Schmidt		●	
—— *latissima* Gregory	●		
—— *lorcana* Azpeitia	●		
—— *lyra* Ehrenberg	●	●	●
—— —— var. *abnormis* Schmidt		●	
—— —— var. *atlantica* Schmidt		●	
—— —— var. *elliptica* Schmidt	●	●	
—— —— var. *intermedia* Peragallo	●	●	
—— —— var. *intermedia* Peragallo forma *elliptica* Peragallo	●		
—— —— var. *perplexa* Peragallo	●		
—— —— var. *recta* Greville		●	
—— —— var. *seductilis* Schmidt	●		

TABLE 1—*Continued*

	(Morón) Seville	(Muro) Majorca	Gard, France
—— —— var. *subcarinata* ? Grunow	●		
—— *major* Kützing		●	
—— *mediterranea* Brun and Cleve	●		
—— *o'swaldii* Janisch	●		
—— *polysticta* Greville	●		
—— *praestes* Ehrenberg		●	
—— *praetexta* Ehrenberg	●	●	●
—— *problematica* Azpeitia	●		
—— *quadriseriata* Cleve and Grunow	●		●
—— *sandriana* Grunow	●	●	●
—— *smithii* Brébisson	●	●	
—— *sparsipunctata* Grove and Sturt	●		
—— *spectabilis* Greville	●	●	
—— *splendida* Gregory	●		
—— *suborbicularis* Gregory	●		
—— *truani* Pantocsek	●		
Nitzchia litoralis ? Grunow	●		
—— *panduriformis* Gregory	●	●	
—— *plana* W. Smith	●		
—— *secalli* Azpeitia	●		
—— *sigma* W. Smith var. *consimilis* Grunow	●		
Omphalopelta moroncnsis Greville	●		
Opephora gemmata (Grunow) Hustedt	●		●
Orthoneis splendida (Gregory) Grunow	●	●	●
Periptera tetracladia Ehrenberg	●		
Plagiogramma hidalgoi Azpeitia	●		
—— *neogradense* Pantocsek var. *curtum* Azpeitia	●		
Pleurosigma affine Grunow	●	●	
—— *sagitta* Tempere and Brun		●	
Pseudauliscus johnsonianus ? Greville	●		
—— *pulvinatus* Cleve	●	●	
Pyrgodiscus armatus Kitton	●		
Pyxidicula stella Azpeitia	●		
Pyxilla baltica Grunow	●		
—— *digitus* Azpeitia	●		
—— —— var. *scutiformis* Azpeitia	●		
—— —— var. *subspinosa* Azpeitia	●		
—— *fungairiñoi* Azpeitia	●	●	
—— *weissflogii* Pantocsek		●	
Radiopalma dichotoma Brun	●		
Rhabdonema adriaticum Kützing	●	●	●
—— *minutum* Kützing var. *sulcata* Fricke	●		
Rhaphoneis amphiceros Ehrenberg	●		●
—— —— var. *rhombica* Grunow	●		
—— *belgica* Grunow	●		
—— *caballeroi* Azpeitia	●		
—— *gemmifera* Ehrenberg	●	●	
—— *hungarica* Pantocsek	●		

TABLE 1—*Continued*

	(Morón) Seville	(Muro) Majorca	Gard, France
—— *kinkeri* Pantocsek	●		
—— *nitida* (Gregory) Schmidt	●	●	
—— *surirella* Ehrenberg	●		
Rhopalodia musculus (Kützing)	●		
Sceptroneis coluber Brun	●		
—— *gemmata* Grunow	●		
Secallia caballeroi Azpeitia	●		
Stephanogonia actinoptychus (Ehrenberg) Grunow	●		●
Stephanopyxis appendiculata Ehrenberg	●		
—— *barbadensis* Greville	●		
—— *corona* (Ehrenberg) Grunow	●		
—— *grunowii* var. ? Grove and Sturt	●	●	
—— *turris* (Greville and Arnott) Ralfs	●		●
Stictodiscus californicus Greville	●	●	●
—— —— var. *areolata* Grunow	●		
—— —— var. *nankoorensis* Grunow	●	●	
—— —— var. *quadrangula* Grunow	●		
—— *confusus* Truan and Witt		●	
—— *gibbosus* Grove and Sturt	●		
—— *grunowii* Truan and Witt	●		
—— *haytianus* Truan and Witt	●	●	
—— *japonicus* Castracane	●		
—— *johnsonianus* Greville var. *trigona* Truan and Witt	●		
—— *nicobaricus* Grunow	●		
—— *kinkerianus* Truan and Witt		●	
—— *parallelus* Pantocsek	●		
—— —— forma *quadrigona* Pantocsek	●		
Surirella baldjickii Norman	●	●	●
—— *fastuosa* Ehrenberg	●		
—— *neumayeri* Janisch	●		
—— *recedens* Schmidt	●		
—— *vaszary* Pantocsek		●	
Synedra acus Kützing	●		
—— *affinis* Kützing	●		
—— —— var. *gracilis* Kützing	●		
—— *cristallina* Ehrenberg		●	
—— *delicatula* Grunow	●		
—— *nitzchioides* Grunow, var.	●		
—— *superba* Kützing	●		
—— *tabulata* Kützing	●		●
—— —— var. *obtusa* Pantocsek	●		
Synedrosphenia giennensis Azpeitia	●		
Terpsinoe americana (Bailey) Ralfs	●		
—— *musica* Ehrenberg	●	●	
Trachyneis aspera Cleve	●		
Triceratium americanum Ralfs var. *minor*	●		●
—— *antediluvianum* (Ehrenberg) Grunow	●	●	
—— —— var. *quadrata*		●	
—— —— var. *pentagona*		●	
—— *antiquum* Pantocsek		●	
—— *arcticum* Brightwell	●	●	●
—— —— var. *californicum* Grunow	●		
—— *balearicum* Cleve and Grunow	●	●	●
—— —— forma *biquadrata* (Janisch) Hustedt	●		
—— *biquadratum* Janisch	●	●	●
—— *blandum* Witt		●	
—— *cambroneroi* Azpeitia	●		
—— *coelatum* Greville		●	
—— *cellulosum* Greville		●	
—— *cinnamoneum* Greville	●		
—— *cucullatum* Pantocsek		●	
—— *elegans* Greville	●		
—— *exornatum* Greville		●	
—— *favus* Ehrenberg	●	●	●
—— —— var. *grande* Brightwell	●		
—— *formosum* Brightwell	●	●	●
—— *giennense* Azpeitia	●		
—— *grundleri* Schmidt	●		
—— *latum* Greville	●	●	
—— *lobatum* Greville	●		
—— *madagascariense* Grunow	●		
—— *moronense* Greville	●		
—— *multifrons* Brun	●		
—— *nicobaricum* Grunow	●		
—— *paralellum* Ehrenberg	●		
—— —— var. *quadrata*		●	
—— —— var. *trigona*		●	
—— *petitti* Pantocsek		●	
—— *punctatum* Brightwell	●		
—— *quinquelobatum* Greville	●		
—— *radiato-punctatum* Schmidt		●	●
—— *reticulum* Ehrenberg	●		●
—— *saratovianum* Pantocsek		●	
—— *setigerum* Bailey	●		
—— *spinosum* Bailey	●	●	●
—— *stokesianum* Greville	●	●	
—— —— var. *moravica* Grunow	●	●	
—— *tessellatum* Greville		●	
—— *thumii* Schmidt	●	●	
—— *trisulcum* Bailey	●		
—— *validum* Grunow	●	●	
—— *weissflogii* Walker and Chase	●		
Trinacia regina Heiberg		●	
Tropidoneis maxima Gregory var. *subalata* Cleve	●		
Xanthiopyxis lacera Forti			●
—— *cingulata* Ehrenberg	●		
—— *oblonga* Ehrenberg	●	●	
—— *panduraeformis* Pantocsek	●	●	
Zygoceras caballeroi Azpeitia	●		

peninsula. Most frequently, they fluctuate between 50 and 60 per cent. It is evident that the proportion of *Globigerina* was considerable and contributed largely to the formation of the deposits in the area of the North Betic strait.

In this way then, detrital beds with a predominance of quartz grains frequently alternate with very pure *Globigerina* ooze. This is a common occurrence in many localities on a greater or lesser scale. The beds are accompanied by glauconitic strata formed, as the neritic zone generally is, in a medium rich in oxygen. The exact distribution of the glauconitic deposits is not yet known, except on the island of Majorca, where they form, within the Burdigalian marls containing *moronitas*, a wide belt extending northeast-southwest through the center of the island.

The globigerinas are generally difficult to determine in thin section although good specimens for specific study commonly occur in the marls. Their distribution in the marly complex seems to be:

1). In the lowest Aquitanian strata large masses of the small shells of *Globigerina bulloides* d'Orbigny and *G. concinna* Reuss, accompanied by *Candorbulina universa* Jedlitschka, *Globorotalia canariensis* (d'Orbigny), and *Globorotalia praemenardii* Cushman and Stainforth (fig. 4), predominate. *Orbulina universa* d'Orbigny is common and its occurrence here is clearly significant, since the studies of LeRoy (1948) and Tromp (1949) indicate this ubiquitously dispersed pelagic species does not seem to be found below the Oligocene.

2). In higher strata, transitional into the Burdigalian, and in the Burdigalian itself, species of *Globigerinoides* tend to predominate, e.g., *G. trilocularis* (d'Orbigny), which is very common in all levels and is followed in lesser proportion by immature specimens of *G. sacculifera* (Brady) and *G. conglobata* (Brady). *Globigerinoides rubra* (d'Orbigny) and *Globigerinella aequilateralis* (Brady) are always very rare. In some strata at Alicante, *Orbulina bilobata* (d'Orbigny) appears abruptly in great abundance. Other forms present in this last Burdigalian planktonic assemblage are *Pullenia quinqueloba* Reuss, *P. salisburyi* R. E. and K. C. Stewart, *Sphaeroidina bulloides* d'Orbigny, *Globorotalia canariensis* (d'Orbigny), *Globorotalia praemenardii* Cushman and Stainforth, *Orbulina universa* d'Orbigny, and *Candorbulina universa* Jedlitschka. Proper to the Burdigalian, at least in our regions, are *Globigerina helicina* d'Orbigny and *G. altispira* Cushman and Jarvis.

Within this marly complex, the *moronitas* appear in certain strata of variable thickness. They are then very fine marly deposits in which the delicate frustules are found mixed with Radiolaria tests and sponge spicules, besides silicoflagellates, Ebriaceae, and dinoflagellates.

Not too thin sections of these marls, treated with hydrochloric acid, reveal an enormous accumulation of shells of siliceous organisms. Many of the diatom frustules belong to thin and long forms but are reduced to fragments. In the marly samples treated with acid, these frustules tend to disappear in the repeated washings because of their tiny size, and, with their disappearance, falsify the true population count of these *moronitas*, since the large cyclic forms, as *Triceratium*, *Coscinodiscus*, *Auliscus*, etc. then seem to prevail over the rest.

So far, more than 500 species have been catalogued. Their number is surprising, especially when compared to the other groups of microorganisms. But such quantitative differences reflect the close delineations made by specialists since the end of the last century. The following genera are represented by a large number of species, all benthonic.

Actinocyclus	*Navicula*
Actinoptychus	*Rhaphoneis*
Aulacodiscus	*Stephanopyxis*
Auliscus	*Stictodiscus*
Campylodiscus	*Surirella*
Cocconeis	*Synedra*
Coscinodiscus	*Triceratium*
Grammatophora	*Xanthiopsis*

On the other hand, truly pelagic diatoms —*Biddulphia*, *Chaetoceras*—are scarce, but this may be due to the difficulty of preserving their delicate frustules. On the whole, the diatoms reveal a large predominance of benthonic forms, characteristic of a sea with temperatures somewhat higher than those of the present Mediterranean. A certain number of species are known at present in the zones situated between the limit of the tides in the Atlantic coasts of Europe.

Radiolaria are abundant; certain strata could more properly be called radiolarian

TABLE 2.—PRELIMINARY RANGE CHART COMPARING KNOWN DISTRIBUTION OF FORAMINIFERAL SPECIES IN OLIGOCENE AND MIOCENE OF CENTRAL AMERICA, TRINIDAD, AND NORTH BETIC STRAIT REGION

	Central America					Spain	
		Cipero marl of Trinidad (Oligocene)					
	Oligocene	I	II	III	Lower Miocene	Burdigalian.-North Betic Strait	Upper Miocene
Pelagic species:							
Globigerina bulloides d'Orbigny	—	—	—	—	—	—	—
Globorotalia canariensis (d'Orbigny)	—	—	—	—	—	—	—
Globigerina concinna Reuss	—	—				—	
Sphaeroidina bulloides d'Orbigny	—				—	—	
Gyroidina scalata Garret	—					—	
Candorbulina universa Jedlitschka	—			—		—	—
Orbulina universa d'Orbigny	—					—	—
Pullenia bulloides (d'Orbigny)	—				—	—	—
Pullenia salisburyi R. E. and K. C. Stewart	—				—	—	—
Globigerinoides sacculifera (Brady)			—	—	—	—	—
Globigerinoides conglobata (Brady)			—	—	—	—	—
Globigerinoides rubra (d'Orbigny)			—	—	—	—	—
Globorotalia praemenardii Cushman and Stainforth			—	—			
Gyroidina altispira Cushman and Stainforth				—		—	
Pullenia quinqueloba (Reuss)					—	—	—
Globigerina helicina d'Orbigny						—	
Globigerina altispira Cushman and Jarvis						—	
Globigerinoides trilocularis (d'Orbigny)						—	—
Benthonic species:							
Chrysalogonium longicostatum Cushman and Bermudez	—	—	—	—	—	—	
Chrysalogonium tenuicostatum Cushman and Bermudez	—	—	—	—	—	—	
Cassidulina subglobosa horizontalis Cushman and Renz	—	—	—	—	—	—	
Chrysalogonium lanceolum Cushman and Jarvis	—	—	—	—	—	—	
Anomalina pompilioides Galloway and Heminway	—	—	—	—	—	—	
Eponides umbonata (Reuss)	—	—	—	—		—	
Frondicularia morreyae Cushman	—	—	—	—		—	
Cassidulina havanensis Cushman and Bermudez	—	—		—		—	
Karreriella subcylindrica (Nuttall)	—		—	—	—	—	
Uvigerina auberiana attenuata Cushman and Renz	—		—	—	—	—	
Robulus clericii (Fornasini)	—		—	—	—	—	—
Cassidulina subglobosa Brady	—	—				—	
Dorothia brevis Cushman and Stainforth	—				—	—	
Gyroidina soldanii nitidula (Schwager)	—					—	
Robulus formosus Cushman	—				—	—	
Uvigerina nuttalli Cushman and Edwards	—				—	—	
Valvulineria palmarealensis (Nuttall)	—					—	
Loxostoma limbatum (Brady)	—				—	—	
Nodosarella tuckerae (Hadley)	—				—	—	
Planulina renzi Cushman and Stainforth	—			—		—	
Planulina marialana Hadley	—		—	—		—	
Pseudoglandulina comatula (Cushman)	—				—	—	

TABLE 2—*Continued*

	Central America					Spain	
	Oligocene	Cipero marl of Trinidad (Oligocene)			Lower Miocene	Burdigalian.-North Betic Strait	Upper Miocene
		I	II	III			
Plectofrondicularia vaughani Cushman	—					—	—
Marginulina pseudohirsuta Nuttall	—		—	—		—	—
Nodosarella subnodosa (Guppy)		—	—	—		—	
Pleurostomella alternans Schwager		—	—	—		—	
Bulmina tuxpamensis Cole			—	—	—	—	
Karreriella chilostoma (Reuss)			—	—	—	—	
Cibicides cicatricosus (Schwager)			—	—	—	—	
Ellipsonodosaria mappa Cushman and Jarvis			—	—	—	—	
Siphogenerina multicostata Cushman and Jarvis			—	—	—	—	
Ellipsonodosaria paucistriata (Galloway and Heminway)			—	—	—	—	
Nodosaria lamellata Cushman and Stainforth			—	—		—	
Siphogenerina seriata (Cushman and Jarvis)			—	—		—	
Karreriella bradyi Cushman					—	—	—
Eggerella bradyi Cushman					—	—	—
Uvigerina rustica Cushman and Edwards			—	—		—	—

rather than diatom beds. This property was also observed by M. Cala, who pointed out (1897) deposits rich in Radiolaria at the granges of "Los Charcos," "Jalofre," "La Vega del Sala," and "Sicilla," near the classic locality of Morón (Seville). I have observed the same detail in the province of Alicante, as well as in the Burdigalian of the Balearic Islands. At any rate, Radiolaria are always very constant and reveal the presence of a rich siliceous plankton in the waters of the North Betic strait.

Most of the species are pelagic, spheroid, with long spines, festooned appendages, etc. The only data we have on them are the generic determinations made some time ago by L. Cayeux and included in the work by M. Cala just mentioned. For lack of bibliography on this group, it has not been possible for me to undertake any systematic study on the species found.

As for silicoflagellates and Ebriaceae, the following species are known, some determined by Raillard (in: Robaux, 1938) and others by me in earlier papers (1940, 1946).

Silicoflagellates:

Mesocena crenulata Ehrenberg var. *diodon* (Ehrenberg) Lemmermann
—— *polymorpha* Lemmermann var. *triangula* (Ehrenberg)
—— —— Lemmermann var. *quadrangula* (Ehrenberg)
—— *circulus* Ehrenberg var. *spiculata* Lemmermann
Dictyocha fibula Ehrenberg
—— —— Ehrenberg var. *rhombica* Schulz
—— —— Ehrenberg var. *longispina* Lemmermann
Distephanus speculum (Ehrenberg) Haeckel
—— —— (Ehrenberg) var. *pentagonus* Lemmermann
Distephanus speculum (Ehrenberg) Haeckel var. *septenarius* (Ehrenberg) Jorgensen
Distephanus speculum (Ehrenberg) Haeckel var. *octonarius* (Ehrenberg) Jorgensen
Distephanus speculum (Ehrenberg) Haeckel var. *pseudofibula* (Ehrenberg) Jorgensen
Distephanus crux (Ehrenberg) Haeckel
—— *polyactis* (Ehrenberg) Deflandre
Cannopilus binoculus (Ehrenberg) Lemmermann
—— *triommata* (Ehrenberg) Lemmermann

Ebriaceae:

Carduifolia gracilis Hovasse
Ammodichium prismaticum Hovasse
Tharanium crassipes Hovasse
Ebria tripartita (Schumann)
Parathranium tenuipes Hovasse
—— *intermedium* Hovasse
Hermesium schultzi Hovasse
—— *adriaticum* Zacharias

Dinoflagellates:
Gymnasterias (Ehrenberg) Schutt

Among the silicoflagellates, *Dictyocha fibula* abounds, both in typical and varietal forms. Species of the genus *Mesocena* are common. On the other hand, *Distephanus* and *Cannopilus* are rarely noted.

Distephanus speculum is abundant in the *moronitas* of the Andalusian zone, probably due to the influence of the waters of the Atlantic in that part of the strait. It is well known that this species is characteristic of the cold waters of northern seas, where it continues to live in present times. *Dictyocha fibula*, on the contrary, predominates in all the strata, as it is a form typical of warm waters, with a summer optimum in the present Mediterranean.

Hermesium adriaticum is another species whose thermal optimum oscillates around 20° C., unlike *Ebria tripartita*, a winter form in the Mediterranean in waters of about 10° C., according to Hovasse. Of the last two species, which they had studied in the French deposit of the department of Gard, de Lapparent and Hovasse (1934) say at the end of their paper: "If the living conditions of these two species have not changed since the Tertiary, we could believe that the deposits of St. Laurent-la-Vernède were formed under conditions of temperature very analogous to those of the present Mediterranean."

The calcareous part of the *moronitas* is made up of an immense quantity of coccoliths, discoasterids, and diminutive globigerinas, which, together with the siliceous forms just mentioned, constituted the nannoplankton of those seas. The species of discoasterids listed below have been determined up to the present. They are always found in the purer marly beds associated with a preponderance of pelagic organisms.

Helidiscoaster barbadiensis Tan Sin Hok
Helidiscoaster ehrenbergi Tan Sin Hok
Discoaster helli Tan Sin Hok
Discoaster molengraaffi Tan Sin Hok
Discoaster quinarius Ehrenberg
Discoaster stella Ehrenberg
Discoaster brouweri Tan Sin Hok
Discoaster brouweri Tan Sin Hok var. *alpha* Tan Sin Hok
Discoaster brouweri Tan Sin Hok var. *beta* Tan Sin Hok
Discoaster brouweri Tan Sin Hok var. *delta* Tan Sin Hok
Discoaster brouweri Tan Sin Hok var. *gamma* Tan Sin Hok

Sponge spicules are also numerous. In most cases they are perfectly preserved specimens, with a transparent opal and a well preserved axial canal. Their extinction between crossed nicols is total and perfect. However, in some strata, they appear altered, corroded, and in process of transformation towards more stable chalcedony, and they then give a polarization of aggregate.

ORIGIN

My studies suggest that the formation of the Spanish *moronitas* represents a marine sedimentary episode of a well-defined sedimentary cycle in the North Betic strait. In spite of all the vicissitudes to which they were subject at various moments of their formation, such as foldings, transgressions, etc., the *moronitas* accumulated as littoral sediments, with no variations of importance, up to the Vindobonian.

Alternations or irregularities in sedimentation do not imply a passage from one agent to another; the conditions propitious to the formation of the *moronitas* persisted over a long period of time and disappeared only when the entire paleogeography of the strait changed radically, with the last tangential Alpine movements that gave birth to the mountain chains of the south of the Iberian peninsula (fig. 3).

The monotonous sedimentation under consideration was due directly to two important factors that operated alternately or simultaneously, but in an equal manner. There existed on one hand, with periods of increase, a local and at times very intense detrital contribution, with its sandstones, detrital limestones, etc., and, on the other hand, a mass of planktonic organisms, carried over the marly deposits by marine currents that possibly were very rapid at certain moments. These currents lifted in turn from the coastal depths where they were developing, innumerable quantities of benthonic diatoms which, once dislodged by the action of the waters, were abandoned later, together with fine quartz grains, sponge spicules, and other materials when the intensity of the currents decreased, and in this way the formation of repeated strata

of unequal thickness, of very pure quartz grains, *Globigerina*, spicules, and *moronitas* was effected. Once the action of the currents had disappeared, the local detrital sedimentation characteristic of the strait recommenced.

As was pointed out at the beginning of these pages, early investigators interpreted the best-developed marly *Globigerina* sediments, with their corresponding beds of *moronitas*, as having originated in an oceanic area more or less near to the coast but nourished exclusively by pelagic elements.

Such an interpretation is no longer tenable, as the very abundance of terrigenous elements in the deposits of the North Betic strait clearly indicates that coastal sedimentation prevailed. Likewise the paleogeographic frame within which the deposits occur makes any interpretation based on bathyal deposition impossible.

Moreover, the planktons present, some calcareous (*Globigerina*, *Discoaster*, Coccolithophoridea) and others siliceous (Radiolaria, silicoflagellates, Ebriaceae), vary greatly, possibly in direct relation to seasonal changes. All our data seem to indicate that these particular pelagic organisms were transported in great masses to the strata in which they are now contained.

None of these deposits, planktonic or terrigenous, is of importance. The evidence of several different transgressions, the sandstones replete with clastic elements, the limestone beds with *Lepidocyclina* or melobesias, and the marly zones containing varied detrital minerals, all tend to reveal a neritic sedimentation of medium depth. However, in the zones of subsidence of the Aquitanian with the Burdigalian, it is possible that strata of greater thickness may be found to exist. But in general the small thickness of all the deposits reveals waters of little depth.

Of interest in connection with this point is the discovery made by Robaux (1938), in the marly beds of Sanlucar de Barrameda (Cadiz), of a fragment of a vascular plant. He interprets its discovery as an indication of a shallow environment of deposition close to a coast covered with dense vegetation. I agree with Robaux in considering the deposits of the North Betic strait to be neritic formations.

The most important contributions that I have been able to make to our knowledge of the Spanish *moronitas* are 1) their wide distribution in the eastern provinces of the peninsula (Alicante, southern Valencia), 2) the connection of the Spanish deposits with the Burdigalian deposits of the Balearics, and 3) the continuation of the Balearic sediments and those of the same age and composition at St. Laurent-La-Vernède (Gard, France) containing identical associations of benthonic diatoms. In view of this, there is no doubt that particularly intense diatomaceous sedimentation took place throughout the Mediterranean Alpine formations during the upper Oligocene in some regions and during the Burdigalian in others.

The diatom deposits of Moravia, which have been known since the last century, and those of the Roumanian Carpathians, discovered by Filipesco in 1930, tend to confirm this. They are all similar to those existing in the zone of the North Betic strait, although, as in the strait itself, they may not be exactly synchronous but were evolved during the course of the ages mentioned.

Filipesco's discoveries were made in the hill of Valenii de Monte (district of Prahova) in the Carpathian flysch. The deposits are diatomaceous marls, called *diatom earth*, and are very rich in frustules. They are associated in different strata with Radiolaria and abundant sponge spicules, as in the Spanish Betic zone. They are upper Oligocene and are overlain by the well-known Kliwa sandstones. The age, then, of these Roumanian *moronitas* coincides in large part with that of the Spanish formations.

In one of his notes, Filipesco (1930) mentions a few species,

Actinocyclus ehrenbergii
Coscinodiscus nitidus
—— *rothii*
—— *denarius*
—— *curvatulus*
Melosira islandica
Navicula sp.
Triceratium sp.

and other forms determined generically only. All are frequent in the Spanish *moronitas*. He considers the Roumanian diatom deposits to have originated in shallow waters and in zones near the coast.

The diatom associations of this ample Alpine zone are the same, even in widely separated deposits. A high percentage of species constitutes the same association, whether from the outcrop of Morón (Seville) in the Atlantic zone, from Muro (Majorca) in the Mediterranean zone, or from the zone of Eastern Europe. The relations of these diatomiferous deposits with the famous ones of Haiti, Barbados, etc., and others of Central America are evident.

We see, then, how widely the diatom deposits are extended throughout the Tethys, not only in the Iberian peninsula but also east and west. This wide diffusion of diatoms is nothing unusual, for affinities are known to exist between other groups of Caribbean and European faunas of the ancient Tethys, e.g., Foraminifera, corals, and equinids.

Numerous foraminiferal species typical of the Oligocene and lower Miocene of the Caribbean and Central American zones are found in the Aquitanian and Burdigalian of the North Betic strait. I have recently begun the study of their possible correlations with populations of the same age from southern Spain. A preliminary chart showing their close affinities is given on page 880.

Robaux (1938), in discussing the irregularity of the presence of the purest *moronitas* beds, says: "Either certain beds alone are rich in debris (diatoms)—and this could be attributed to brusque variations in conditions of living during one sole geological age, or to the activity of the marine currents of that age—or else we are dealing with formations of the same aspect but of different ages; in the latter case a complete revision of the faunas of the alleged *moronitas* is required in the regions where this formation has been noted."

The Spanish *moronitas* are not all synchronous but are distributed within the periods mentioned; in some localities they can be Aquitanian and in others Burdigalian. That their formation may be attributed to the action of marine currents prevailing throughout the strait or also to seasonal epochs was sustained in an earlier paper (Colom, 1946).

From all this we can conclude that the *moronitas* do not represent a small detail of the marine sedimentation in the North Betic strait, of interest only to diatomologists, but rather that, because of their importance, they form part of a vast paleontological cycle that developed throughout the Alpine formations from the Roumanian Carpathians in the east to their equivalents of the Caribbean area in the west. The diatom deposits of North Africa (Morocco, Algiers, Tunis) are poorly known as yet and do not concord in age with those of the North Betic strait. Most of them seem localized in the highest units of the upper Miocene. They belong, therefore, to a later sedimentary cycle.

With the upper Miocene (Vindobonian) there began in Spain another type of sedimentation completely different from that which characterized the North Betic strait. In it no *moronitas* are found. For that reason it can be affirmed that the Aquitanian-Burdigalian sedimentation was not repeated in Spain but it was, apparently, in North Africa and on a large scale.

REFERENCES

ANDERSON, V., 1933, The diatomaceous and fish-bearing Beida stage of Algeria: Jour. Geology, vol. 41, p. 673.

——, 1936, Geology in the coastal Atlas of western Algeria: Geol. Soc. America, Mem. 4.

ANDRADE DA SILVA, A., 1946, Diatomaceas fosseis de Portugal: Bol. Soc. Geol. Portugal, vol. 6.

ARAMBOURG, C., 1927, Les poissons fossiles d'Oran: Bull. Carte Geol. Algerie, Ser. Paleontologique, 2 vols., Alger.

AZPEITIA, F., 1911, La diatomologia española en los comienzos del siglo XX: Asoc. Esp. Prog. Ciencias, Congr. de Zaragoza.

BRIVES, A., 1897, Les terreins Tertiaires du bassin du Chelif et du Dahra: Thèse Fac. Sci. Lyon, 1 vol.

CALA, M., 1897, La geologia del termino de Moron y descripcion de su yacimiento diatomifero: Ann. Soc. Esp. Hist. Nat., vol. 6, p. 83.

CALDERON, S., and PAUL, M., 1886, La "moronita" y los yacimientos diatomaceos de Morón (Sevilla): Ann. Soc. Esp. Hist. Nat., vol. 15, p. 477.

CARBONELL, A., 1926, Nota sobre los depositos de foraminiferos Terciarios de Cordoba: C. Rend. XIV Sess. Congr. Geol. Intern. Madrid.

COLOM, G., 1940, Arquemonadineas, Silicoflagelados y Discoasteridos fosiles de España: Las Ciencias, no. 2, p. 343.

——, 1946, Los sedimentos Burdigalienses de las Baleares: Estudios Geologicos, no. 3, p. 21.

——, 1947, Los foraminiferos fosiles de las facies

pelagicas del Mioceno de España: Estudios Geologicos, no. 5, p. 131.

CUSHMAN, J., and STAINFORTH, R., 1945, The Foraminifera of the Cipero marl formation of Trinidad, British West Indies: Cush. Lab. Foram. Res., Spec. Publ. no. 14.

DOUVILLÉ, R., 1906, Esquisse geologique des Prealpes Subbetiques, Partie Centrale: Thèse, Paris.

FALLOT, P., 1930, Etat de nos connaissances sur la structure des chaines Betique et Subbetique: Livre Jub. Soc. Geol. France, p. 279.

——, 1948, Les Cordilleres Betiques: Publ. Inst. Invest. Geol. "Lucas Mallada," Madrid, no. 8, p. 83.

FILIPESCO, M. G., 1930, Sur la nature des roches siliceuses de l'Eperon de Valenii de Munte: Acad. Roumaine, Bull. Sect. Scientifique, no. 6, p. 1.

——, 1931, Note sur la presence de roches d'origine organique dans les couches de Podul Morii, a Valenii de Munte, distr. de Prahova: C. Rend. Sean. Inst. Geol. Roumanie, vol. 19, Sean. 3 Avril.

——, 1931, Sur les roches siliceuses d'origine organique et chimique de l'Oligocene des Carpathes roumaines: C. Rend. Acad. Sci. Paris, vol. 192, p. 1040.

——, 1932, Contribution a l'etude micrographique du Flysch des Carpathes roumaines (Grès de Kliwa): C. R. Somm. Soc. Geol. France, no. 4, p. 52.

LAPPARENT, J. DE, and HOVASSE, R., 1934, Sur un gisement de terre a diatomees d'age Miocene inferieur: C. R. Somm. Soc. Geol. France, no. 14, p. 205.

LEFEBURE, P., 1935, Diatomees contenues dans le depot fossile marin de Saint Laurent-la-Vernède: Bull. Soc. Franc. Microsc., vol. 4,

LE ROY, L. W., 1948, The foraminifer *Orbulina universa* d'Orbigny, a suggested middle Tertiary time indicator: Jour. Paleontology, vol. 22, pp. 500–508.

RENZ, H. H., 1942, Stratigraphy of northern South America, Trinidad and Barbados: Proc. 8th Amer. Sci. Congr., vol. 4, Geol. Sci., p. 513.

ROBAUX, A., 1938, Les marnes blanches Aquitaniennes de Sanlucar de Barrameda (prov. de Cadiz): Bull. Soc. Geol. France, vol. 8, p. 697.

——, and RAILLARD, H., 1938, Les marnes blanches de la plaine de Guadalquivir: Bull. Mensuel Soc. Sci. Nancy, nouv. ser., vol. 3, p. 23.

SAVORNIN, J., 1931, La geologie algerienne et Nord-Africaine depuis 1830: Serv. Carte Geol. Algerie, 1 vol.

TROMP, S. W., 1949, The value of Globigerinidae ratios in stratigraphy: Jour. Paleontology, vol. 23, pp. 223–224.

JOURNAL OF PALEONTOLOGY, VOL. 26, NO. 6, PP. 886–901, PLS. 126–129, 4 TEXT FIGS, NOVEMBER 1952

A CLASSIFICATION OF PENNSYLVANIAN CONODONT ASSEMBLAGES

F. H. T. RHODES
University of Durham, Durham, England

ABSTRACT—A study of the conodont faunas of the Pennsylvanian black shales of Illinois and Kentucky reveals that three types of natural assemblages are represented. Each of these is recognized as a new natural genus, *Scottella*, *Duboisella*, and *Illinella*. These genera are described in detail and their relationship to existing form genera and species and their stratigraphical ranges are also discussed.

INTRODUCTION

EVER since conodonts were first recorded and described by Pander in 1856 there has been considerable controversy as to their zoological affinities. The opinions of the earlier workers have been summarized by Stauffer and Plummer (1932, pp. 18–20), and a brief resumé of the more recent research in the field of conodont affinities is given by Ellison (1944, pp. 138–139). As these accounts are readily available, it seems unnecessary to include a general historical summary in the present paper.

The lack of agreement concerning the affinities of the conodonts has raised a number of difficulties in classification. Pander summarized the problem as follows (1856, p. 18: translation from Hass, 1941, p. 73): "Not only are we completely ignorant of the animals that possessed the lower Silurian teeth but also there are no descendants or living animals that have a similar type of tooth structure. We do not know what kind of teeth we are investigating, whether they belong to the jaw-bone, the palate or the tongue. Moreover, we do not know whether each special form may serve as a sufficient foundation for the erection of a specific category, or whether the various forms originated from the same animal." Subsequent workers have recognized that this latter problem, i.e., whether or not various forms of conodonts originated from the same animal, is one which is of fundamental importance in an understanding of the relationships of these fossils.

The value of the evidence afforded by a study of natural conodont assemblages, which are presumed to represent the remains of individual animals, was first recognized by Hinde (1879, pp. 361–364) who described what he concluded to be a natural assemblage from the Genessee shale at North Evans, New York. He included within his species *Polygnathus dubius* forms later referred by Branson (1933) to the genera *Lonchodina*, *Hindeodella*, *Polygnathus*, *Bryantodus* and *Spathodus*. These identifications by Branson were based upon isolated specimens upon which Hinde, considering them to be similar to the various forms included in the natural assemblage, had made his original descriptions. The genus *Polygnathus*, as originally designated by Hinde (1879, p. 361), was erected to include "an animal possessing numerous minute and curiously formed conodont teeth and similarly minute tuberculated plates grouped together, but of which the natural arrangement is not at present known." The generic diagnosis was subsequently revised by Bryant (1921, pp. 22–23) and again revised by Ulrich and Bassler (1926, p. 43) to include only certain forms of platform-type conodonts. Bryant (1921, pp. 9–23) considered that Hinde's assemblage may have represented coprolitic material, and Schmidt (1934, p. 76) stated that the forms represented in Hinde's assemblage belonged to different individuals.

Bryant (1921, p. 24) and other more recent workers recognized the presence of right and left forms of conodonts but it was not until 1934 that further attention was paid to natural assemblages when Scott described a number of specimens from the Quadrant shales of Montana and Schmidt described nine similar assemblages from the lower Namurian of Germany. Schmidt (1934) observed that the natural conodont assem-

blage represented by his specimens comprised one pair of *Gnathodus*, one pair of *Bryantodus*, and a number of pairs of *Lonchodus* (including *Hindeodella*) and concluded that these elements represented respectively the mandibles, hyal teeth and gill-basket of an armourless member of the Placodermi, to which he gave the name *Gnathodus integer*, assuming a natural association of the conodont remains with the impression of a small spined fish, which he found in the same beds.

There seems, however, to be little evidence for this assumption, since conodonts are frequently found in association with almost every type of contemporaneous marine organism and they are also known to occur in beds which contain no trace of any fish remains. It is difficult to understand why the impression of this fish, if it does represent the animal which bore the conodonts, should not be preserved around the almost undisturbed conodont assemblages, which would seem to indicate very still bottom conditions, and yet be perfectly preserved elsewhere in the same bed.

Further reference to Schmidt's illustrations will reveal that the genera of conodonts represented in his assemblages should be more correctly identified as: one pair of *Streptognathodus* or *Idiognathodus*, one pair of *Ozarkodina*, one pair of *Synprioniodina*, and four pairs of *Hindeodella*. It is impossible to identify from the original illustrations the species represented by these genera.

Jones (1938) gave brief descriptions of a number of assemblages from the Seminole formation of Oklahoma. Although all of these are probably incomplete and the generic identifications of some specimens appear to be incorrect, the assemblages clearly represent similar forms to those described in the present paper. *Duboisella* is not represented in Jones' collection and an assemblage described by Jones as the *Bicarinodus* type has not been included in the present descriptions. This latter assemblage is known only from specimens in Jones' collection and, as described by Jones, is almost certainly incomplete. It appears, however, to be very similar to specimens of the genus *Scottella* and probably represents a distinct species within that genus.

Demanet (1939) figured a fragment of what he considered to be a conodont attached to the branchial arch of a specimen of *Coelacanthus lepturus* Agassiz. The present author has, through the kindness of Dr. C. J. Stubblefield, been able to study this specimen. The fragment which Demanet described does not appear to be a true conodont, although it has a superficial resemblance to these fossils.

Scott (1942) described other assemblages from the Heath formation of Montana and erected two new genera based on these assemblages: *Lochriea* comprising *Spathognathodus*, *Prioniodella*, *Prioniodus*, and *Hindeodella*, and *Lewistownella* comprising *Cavusgnathus*, *Subbryantodus*, *Prioniodus*, and *Hindeodella*. He distinguished two species in the former genus (based upon minor variations in the form of the component conodonts) and one in the latter.

DuBois (1943) described two types of assemblages from the Pennsylvanian of Illinois. He described the first type as containing one pair of *Streptognathodus*, one pair of *Ozarkodina*, four pairs of *Hindeodella*, and a fragment of *Synprioniodina* or *Telumodina*. The second type of assemblage was represented by two specimens, the first of which contained the "form genera" *Distacodus*, *Prioniodus*, and *Lonchodina*, and the second of which contained *Distacodus*, *Euprioniodina* or *Hibbardella*, and *Lonchodina*.

DuBois considered that certain "brown carbonaceous films" associated with the conodonts represented "a fossilized portion of the cuticle of some worm-like creature" and regarded worm trails and burrows which were present in the shales as also being associated with the conodonts. He, like Scott, concluded that conodonts were related to the Annelida.

Cooper (1945) recorded, but did not describe in detail, an assemblage from the lower Kinderhook of Kentucky. He stated (p. 1153) that this assemblage contained five pairs of denticulated bars (none of them polygnathids) with one complete unpaired *Hibbardella*. This assemblage may represent a member of the genus *Duboisella* (p. 895).

The purpose of the present paper is to describe some new conodont assemblages from the Pennsylvanian of Illinois and Kentucky and to attempt to build up a

detailed natural classification treating such assemblages as biological units.

The author takes pleasure in acknowledging the continuous help and guidance which he has received from Dr. Harold W. Scott of the University of Illinois, under whose supervision the work was undertaken. Dr. Harold R. Wanless has made many valuable suggestions and has given much assistance in the collection of material. Dr. E. P. DuBois of the Illinois State Geological Survey has generously given the author permission to study the assemblages which he described in 1943. Mr. E. Wojtas was responsible for the photography and Mr. Ronald M. Beveridge drew the text figures. Miss Rosa M. Nickell kindly typed the manuscript. To these, and others who have helped in various ways, the author expresses his sincere gratitude. The work was carried out during the tenure of a post-doctoral fellowship at the University of Illinois, which the author gratefully acknowledges.

THE INTERPRETATION OF CONODONT ASSEMBLAGES

Some workers have suggested that what others have described as natural assemblages represent only random associations of conodonts. Thus, Branson and Mehl (1936, p. 233) write "In our opinion the weight of evidence is . . . against a complex dental armament. . . . Doubt is cast on the assemblage finds as normal associations because the analyses of one, or many, samples from a productive zone . . . fail to show proportional numbers of kinds supposedly found in one individual. . . . An apparently insurmountable difficulty to the group assemblages is the fact that the involved genera are not coextensive in their stratigraphic range." The same authors (1937, p. 270) state "The writers find that most of the conodont assemblages from the Heath, the formation from which Scott's specimens came, are in excretionary matter."

It should first be stated, in reply to these criticisms, that both random assemblages and excretionary assemblages are known to exist (e.g., DuBois, 1943, pl. 25, fig. 7) and these may sometimes be confused with natural assemblages. Thus, closer investigation of the specimen figured by DuBois in plate 25, fig. 17, shows it to represent a random assemblage composed of a mixture of components of the genera *Scottella* and *Duboisella*. Excretionary assemblages are frequently, but not invariably, associated with a discoloration, although it should be noted that individual specimens present in such assemblages are not always damaged or crushed. Scott (1942, p. 296), commenting on the suggestion that the natural assemblages which he described are coprolitic in origin, writes " . . . it would be strange indeed to find a group of animals that had such a perfectly balanced diet that the excretal material would consist time after time of one pair of prioniods, one pair of spathognaths, one pair of prioniodells, and approximately four pairs of hindeodells" (the components of Scott's genus *Lochriea*). The "balanced diet" of these presumed predatory creatures is all the more strange when it is observed that the assemblages described by Schmidt (1934), DuBois

---

EXPLANATION OF PLATE 126

Scottella typica Rhodes, n. gen., n. sp. (p. 891)

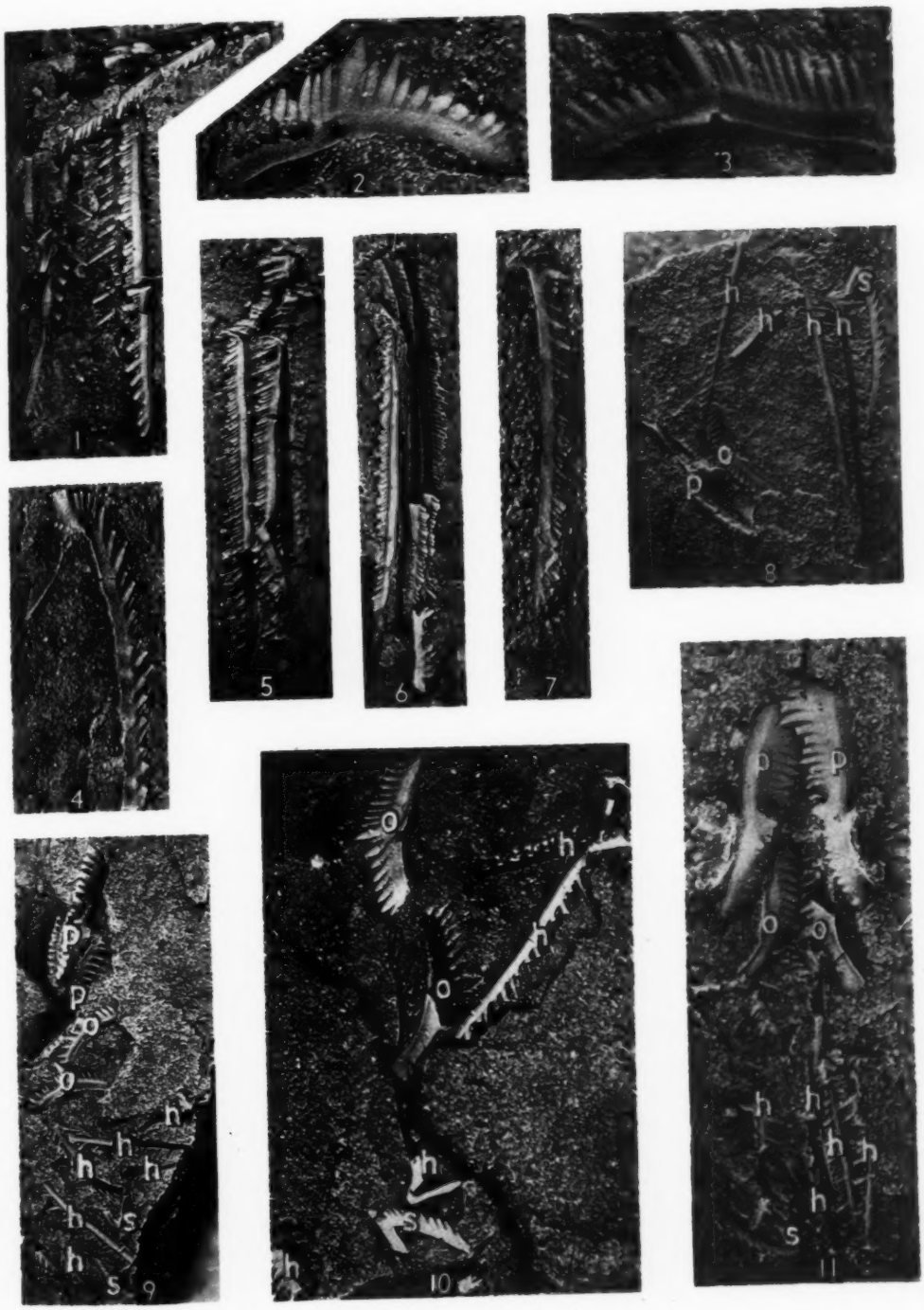
FIGS. *1*, *5–7*—*Hindeodella* components. *1*, four *Hindeodella* components, showing general form and orientation, X-1481; *5*, two *Hindeodella* components, of which the one on the right shows apparent repair of a broken part, X-1485; *6*, *Hindeodella* components, X-1486; *7*, *Hindeodella* component showing form of anterior end, X-1487.

2, *3*—*Ozarkodina* components. *2*, *Ozarkodina* component, X-1482; *3*, *Ozarkodina* components, X-1483.

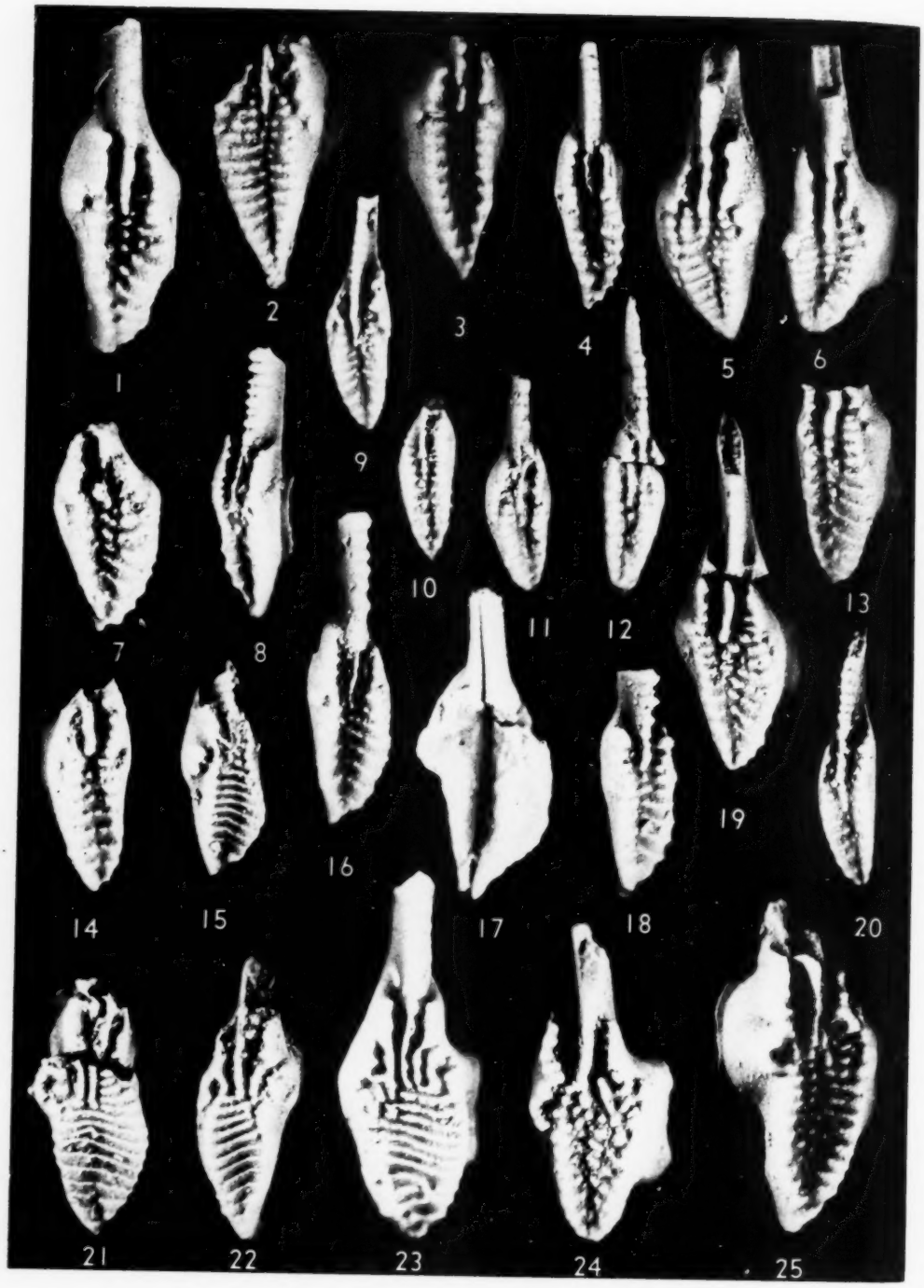
4—*Synprioniodina* component, X-1484. Figs. *1–7*, ×36.

8–11—Assemblages representing *Scottella typica* Rhodes, n. gen., n. sp., with components marked as follows: *h* = *Hindeodella*; *s* = *Synprioniodina*; *p* = polygnathid; *o* = *Ozarkodina*. *8*, paratype, X-1488; *9*, paratype, X-1489; *10*, paratype, X-1490; *11*, holotype, X-1480. Figs. *8–11* ×24.

All specimens except figs. *4–6* from black shale below La Salle limestone, Loc. 1. Specimen shown in fig. *4* from shale above No. 9 Kentucky Coal, Loc. 6; specimen shown in fig. *5* from shale above No. 10 coal, Loc. 2; specimen shown in fig. *6* from shale above No. 2 (?) coal, Loc. 7.



Rhodes, Pennsylvanian Conodonts



Rhodes, Pennsylvanian Conodonts

(1943) and the present author are composed of the same genera in the same numbers. Comparison of these assemblages from such widely separated areas as Europe and the United States will at once show them to be similar in form, although publications of these workers differed both in the generic names used to describe the components and in the interpretation of the zoological affinities of the assemblages.

Conodonts are not abundant in Pennsylvanian black shales but more than two hundred assemblages have been studied, representing the three genera described in the present paper. Of these specimens, only two reveal any admixture of forms previously recognized as valid genera which are not commonly associated in the same natural assemblage.

The problem of numerical distribution of specimens in relation to their association in natural assemblages has been carefully analyzed by DuBois (1943, p. 157) and preliminary studies by the present author suggest that the numerical distribution of isolated components supports the present assemblage arrangement. It should not, however, be overlooked that some forms of conodonts may be more easily transported than others by any bottom currents which may be acting during the deposition of the sediments. Scott (1943, pp. 296–297) has pointed out that since the addition or subtraction of certain kinds of teeth would be a normal consequence of the evolution of the group, the fact that the involved genera are not co-extensive in their stratigraphical ranges need present no problem. It should also be observed that some "genera" of conodonts are present in more than one "biological genus" (as represented by natural assemblages). Thus, *Lonchodina* is present in both *Duboisella* and *Illinella*, and *Hindeodella* is present in *Lochriea*, *Lewistownella* and *Scottella*. It appears, however, that the "specific type" of conodont present is not the same in assemblages belonging to different biological genera or species.

CLASSIFICATION

The majority of conodont workers have adopted the binominal system of classification and have erected genera and species based on differences in individual conodonts. This division has proved to be of considerable utilitarian value in stratigraphical problems but the study of assemblages indicates that such a classification is of little biological value. The majority of these "form species" are, however, well founded for it appears, with a few important exceptions, that natural species (as represented by conodont assemblages) are represented by a combination of various "form species" which are not duplicated in other natural species. For this reason, and in view of the stratigraphical value of the present classification and the rarity of natural assemblages, it seems preferable to adopt the recommendation of Hass (1941, p. 80) and Scott (1942, p. 295) that the present system of classification should be retained.

It would, however, be unfortunate to

EXPLANATION OF PLATE 127

Polygnathid components of *Scottella typica* Rhodes, n. gen., n. sp. (p. 891)

All views oral unless otherwise stated. All figs. ×36.

FIGS. *5–6*, *11–12*—Paired polygnathids from the same assemblages. *5–6*, *Streptognathodus excelsus* Stauffer and Plummer, X-1509; *11–12*, *Streptognathodus elegantulus* Stauffer and Plummer, X-1510. *1*, *16*, *Streptognathodus gracilis* Stauffer and Plummer, *1*, X-1492-28; *16*, oral-lateral view, X-1491-21. *2*, *Streptognathodus* cf. *S. wabaunsensis* Gunnell, X-1491-7. *3*, *4*, *8*, *Streptognathodus* cf. *S. elongatus* Gunnell, *3*, X-1491-2; *4*, X-1492-42; *8*, oral-lateral view X-1491-23. *7*, *19*, *Streptognathodus* cf. *S. eccentricus* Ellison, *7*, X-1492-31; *19*, X-1491-10. *9*, *Streptognathodus* cf. *S. cancellosus* (Gunnell) Ellison, X-1491-30. *10*, *20*, *Streptognathodus elegantulus* Stauffer and Plummer, *10*, X-1492-41; *20*, oral-lateral view, X-1491-16. *13*, *Streptognathodus* cf. *S. simulator* Ellison, X-1491-13. *14*, *Streptognathodus excelsus* Stauffer and Plummer, X-1492-40. *17*, *25*, *Streptognathodus* cf. *S. excelsus* Stauffer and Plummer, *17*, aboral view, X-1491-28; *25*, oral-lateral view, X-1491-1. *15*, *Idiognathodus* cf. *I. delicatus* Gunnell, oral-lateral view, X-1491-18. *18*, *Streptognathodus* cf. *S. oppletus* Ellison, oral-lateral view, X-1491-20. *21*, *Idiognathodus* cf. *I. antiquus* Stauffer and Plummer, X-1491-13. *22*, *Idiognathodus acutus* Ellison, oral-lateral view, X-1491-5. *23*, *Idiognathodus* cf. *I. magnificus* Stauffer and Plummer, X-1491-29. *24*, *Idiognathodus claviformis* Gunnell, X-1491-15. All specimens from black shale below LaSalle limestone, Loc. 1.

neglect the evidence afforded by natural assemblages and Hinde (1879), Schmidt (1934) and Scott (1942) have attempted to establish a classification based upon such evidence. The principles upon which such a classification should be erected present further problems. Some types of assemblages differ so strikingly in the form of their component conodonts that the majority of taxonomists would agree that they should be recognized as distinct genera. Other assemblages, (e.g., *Lochriae montanaensis* Scott and *L. agnewi* Scott) contain conodonts which are included within the same "form genera" but which belong to different "form species." Scott (1942, pp. 298–299) has set a precedent by describing such assemblages as distinct species within a single biological genus. There are, however, still other assemblages (e.g., those of the genus *Scottella*) which are basically similar but which contain component elements exhibiting a complete gradation from one "form genus" to another. It would appear that such differences represent the normal degree of variation to be expected in some of the elements of a single natural species and this question is more fully discussed below. Some component conodonts, however, exhibit a remarkable regularity in form.

An attempt has been made to indicate the extent of the variations within individual components of natural assemblages by placing existing "form species" in synonymy. This does not imply that such forms are necessarily "conspecific," but rather that they appear to represent the normal variations exhibited by the components of a natural assemblage or biological species.

Hass (1941, p. 80) has commented on the variability of conodont "form species" and has urged that the effects of suppression, of rejuvenation, and of stage of ontogeny of the specimens be taken into account in the erection of new species. The present study supports Hass' views and emphasizes the need for the wide conception of "form species" which more recent workers (e.g., Ellison, 1941) have adopted.

The present study appears to offer no new evidence with regard to the zoological affinities of the conodonts. Until more definite evidence is forthcoming no final opinion can be given, although the writer is of the opinion that evidence afforded by the study of assemblages tends to support their association with an extinct group of annelids.

SYSTEMATIC PALEONTOLOGY

Genus SCOTTELLA Rhodes, n. gen.
in part GNATHODUS Schmidt, 1935
not GNATHODUS Pander, 1856

Diagnosis.—Natural conodont assemblages consisting of paired conodonts of the "form genera" *Idiognathodus* or *Streptognathodus*, *Ozarkodina*, *Hindeodella*, and *Synprioniodina*.

Description.—It appears probable that this genus is characterized by the presence of one pair of *Idiognathodus* or *Streptognathodus*, one pair of *Ozarkodina*, one pair of *Synprioniodina*, and four pairs of *Hindeodella*. These are arranged longitudinally as paired components, as shown in Fig. 2. The genus is at present represented by only two species, *S.* (*Gnathodus*) *integer* Schmidt and *S. typica*, which is described below. Subsequent collecting may prove that the arrangement and the number of components are variable.

Type species.—*Scottella typica* Rhodes, n. sp.

Discussion.—There can be little doubt that, in spite of his apparent misidentification of some of the component elements, the specimens described by Schmidt are generically similar to those described below. It is impossible to identify with certainty the "form species" represented in Schmidt's illustrations. The present specimens are recognized as a new species inasmuch as they appear to be different from those described by Schmidt.

The genus *Gnathodus* was originally used by Pander to include a type of polygnathid conodont, and Schmidt incorrectly identified some of his polygnathid components as representatives of this genus. The genus *Gnathodus*, therefore, was redefined by Schmidt to include the complete type of assemblage which he described and also the placoderm remains which he assumed to be part of the same animal. Since, however, there appears to be little evidence for such an assumption and since the majority of conodont workers still restrict the use of *Gnathodus* to a certain type of polygnathid, it is necessary to use another generic name to include these natural assemblages.

It will be observed that the genus *Scottella* bears a marked similarity to *Lewistownella* Scott. The latter is a Mississippian form but all its component "generic" elements are known to occur in the Pennsylvanian. The similarity between the two forms lies in the inclusion in each of similar members of polygnathid, *Hindeodella*, and *Ozarkodina* components. The components of each type of assemblage are, however, specifically and, in the case of the polygnathid components, generically distinct.

Geological range.—The range of this genus is apparently limited by its polygnathid components, of which *Idiognathodus* is known only from the Pennsylvanian and *Streptognathodus* from the Pennsylvanian and the Wolfcamp (Ellison, 1946). Schmidt's specimens were collected from the lower Namurian (lower Pennsylvanian) of Germany.

SCOTTELLA TYPICA Rhodes, n. sp.
Plate 126, figs. 1–11; plate 127, figs. 1–25

Unnamed assemblages. DUBOIS, 1943, pl. 25, figs. 1–6, 8–14, 20, 21.

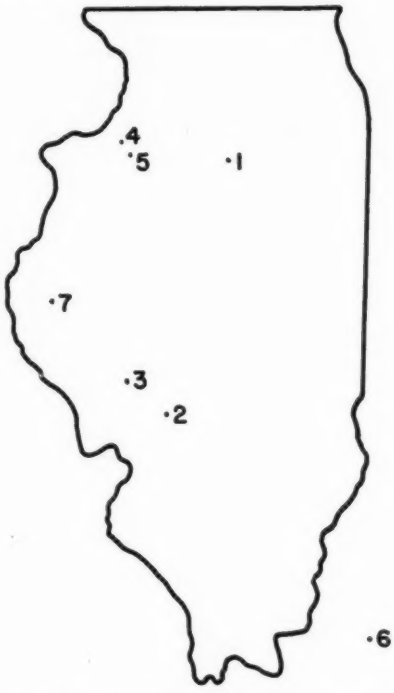


FIG. *1*—Outline map of Illinois showing positions of localities from which collections were made. Approximate scale: 1 inch to 104 miles.

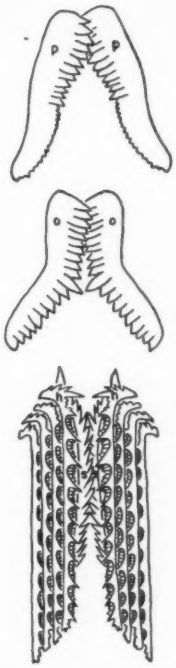


FIG. *2*—*Scottella typica* Rhodes, n. gen., n. sp. Diagrammatic representation to illustrate the general form and number of the individual components. The relative arrangement of the component conodonts is diagrammatic. *p*, polygnathid component; *o*, *Ozarkodina* component; *s*, *Synprioniodina* component; *h*, *Hindeodella* component. Approximately ×15.

Material.—Eighty assemblages from the black shale below the LaSalle limestone, Loc. 1.

Nine assemblages from the black shale above Coal No. 10, Loc. 2.

Two assemblages from the black shale above Coal No. 8, Loc. 3.

Three assemblages from the black shale above Coal No. 9, Loc. 6.

Twenty-nine assemblages from the black shale above Coal No. 2, Loc. 7.

Diagnosis.—Natural assemblages made up of one pair of *Idiognathodus* or *Streptognathodus*, one pair of *Ozarkodina*, one pair of *Synprioniodina*, and four pairs of *Hindeodella*. Components are of the type described in detail below and are arranged in an elongated paired series (Fig. 2).

Description:

Hindeodella component (Plate 126, figs. 1, 5–7).—Greatly elongated units, straight

or very feebly arched in a vertical plane; basal bar with strongly convex lateral faces and aboral surface excavated by a thin, shallow, longitudinal groove. Anterior bar short, down-flexed, making an angle of about ninety degrees with the posterior bar in a vertical plane and laterally twisted so that its denticles are out of line with those of the posterior bar; denticles of anterior bar recurved so that they point upwards; up to six in number, unequal in length with gently convex lateral faces and sharp anterior and posterior edges. Fang a little wider and longer than the main denticles, but not conspicuously so; strongly convex lateral faces, sharp anterior and posterior edges; sharply pointed; inclined slightly posteriorly so that it lies subparallel to the other denticles of the posterior bar. Major series of denticles of posterior bar widely spaced, separated by concave depressions of the oral surface of the bar when seen in one lateral view; usually about twelve in number; similar in form and inclination to the fang; subequal in size but the denticles near midlength sometimes tend to be a little longer than the rest; distance between major denticles variable, but tending to be greatest in the mid-portion of the bar. Minor series of denticles occurring in varying numbers between the major denticles. Towards the posterior tip of the bar all denticles tend to become subequal in size and the inclination is slightly increased.

Ozarkodina component (Plate 126, figs. 2, 3).—The *Ozarkodina* components of the assemblages studied may all be included within the species *O.* (*Bryantodus*) *delicatula* (Stauffer and Plummer) Ellison. There is an appreciable variation in the form of specimens, especially in the degree of flexing of the bar in a vertical plane and in the relative depth of the anterior bar. It will be noted, however, that there is a similar variation in specimens referred by Ellison to this species (1941, pl. 20, figs. 40–42, 47), and Ellison's specific description is adequate to cover all the specimens which have been studied.

Synprioniodina component (Plate 126, fig. 4).—The *Synprioniodina* components may all be referred to the "form species" *S. microdenta* Ellison. Although Ellison's specific description is applicable to all the present specimens, it does not include any description of the over-all form of these units. The following additional description of the more nearly complete specimens found in these assemblages is therefore included.

Posterior bar greatly elongated, about three times as long as the anterior bar in complete specimens; straight or very feebly arched in a vertical plane; more or less uniform in depth; lateral faces gently convex; the size of denticles and the distance between them tending to be greater in the posterior three-quarters of the bar, in which portion they are subequal and subparallel; the inclination of denticles nearest the apical fang is increased, so that they lie subparallel to the fang. Anterior bar tapering towards its distal end; gently flexed in a vertical plane so that its aboral margin is convex and slightly twisted out of plane of posterior bar; denticles crowded, smaller than, but similar in form to, those of the posterior bar, tending to decrease in size towards the distal end of the bar and lying subparallel to the apical fang. Aboral surface of both bars excavated by shallow longitudinal groove.

Idiognathodus-Streptognathodus component (Plate 127, figs. 1–25).—The available evidence suggests that this component is the most variable element in assemblages of the present species. Assemblages in which the other three elements are "conspecific" are found to contain polygnathid components representing eight species of these two "form genera," and other polygnathids found in the same bed as the assemblages, but not intimately associated with them, represent seven additional species of the genera. It seems very probable that these latter specimens are derived from similar assemblages.

This variation in minor details of form of the oral surfaces of the polygnathids of a single natural species confirms the tentative suggestion of this variation made by Scott (1942, p. 295). It should be noted that Ellison (1941) not only recognized the general variation in form of the polygnathids by placing many existing "species" in synonymy but also illustrated the differences in form resulting from the relative ages of in-

dividual specimens. He remarks (p. 127), "each specimen differs in some way from all, others," and lists four "border-line species" of *Streptognathodus*, transitional in form between that genus and *Idiognathodus*.

It seems that there is very little variation in the form of the two polygnathids which are present in any one individual. Reference to Plate 127, figures 5, 6, 10, 11 will reveal that such specimens, although representing right and left forms, can be readily identified as belonging to the same species. No specimen studied has revealed any significant difference between two such components although they do not appear, however, to be exactly identical.

Holotype.—University of Illinois, No. X-1480. From black shale below LaSalle limestone, Loc. 1.

Paratypes.—University of Illinois, Nos. X-1488–1490. From black shale below LaSalle limestone, Loc. 1.

Discussion.—A study of the various elements suggests that the following "form species" are represented by the components of *Scottella typica*.

Hindeodella component:

cf. *Hindeodella* sp. Gunnell, 1931, p. 249, pl. 29, fig. 12 only.
H. delicatula Stauffer and Plummer, 1932, p. 34, pl. 1, figs. 3, 7.
H. irregularis Stauffer and Plummer, 1932, p. 35, pl. 1, figs. 5, 6, 9, 12.
H. diseriata Stauffer and Plummer, 1932, p. 34, pl. 1, figs. 8, 10, 16, 17.
Hindeodella sp. C Stauffer and Plummer, 1932, p. 36, pl. 1, fig. 14.
cf. *Hindeodella* sp. E Stauffer and Plummer, 1932, p. 36, pl. 1, fig. 18.
cf. *H. armata* Stauffer and Plummer, 1932, p. 33, pl. 1, figs. 19, 20.
cf. *Hindeodella* sp. Harris and Hollingsworth, 1933, p. 198, pl. 1, figs. 3a, b.
Hindeodella sp. Youngquist and Heezen, 1948, p. 769, pl. 118, fig. 2.
Hindeodella iowaensis Youngquist and Downs, 1949, p. 165, pl. 30, fig. 12.

Ozarkodina component:

Ozarkodina delicatula (Stauffer and Plummer)
Bryantodus delicatulus Stauffer and Plummer, 1932, p. 29, pl. 2, fig. 27.
Bryantodus nasutus Stauffer and Plummer, 1932, p. 29, pl. 2, fig. 28.
Bryantodus sulcatus Stauffer and Plummer, 1932, p. 30, pl. 2, figs. 11, 14, 30.
Bryantodus delicatus Gunnell, 1933, p. 267, pl. 32, fig. 43.
Bryantodus rugosus Gunnell, 1933, p. 268, pl. 32, fig. 44.
Bryantodus strigatus Gunnell, 1933, p. 268, pl. 32, fig. 45.
Bryantodus strigillatus Gunnell, 1933, p. 268, pl. 32, fig. 46.
Ozarkodina delicatula Ellison, 1941, p. 120, pl. 20, figs. 40–42, 47.
Ozarkodina delicatula Ellison and Graves, 1941, pp. 3–4, pl. 1, figs. 12–14.
Ozarkodina delicatula Branson, 1944, p. 327.
Ozarkodina delicatula Youngquist and Heezen, 1948, pp. 771–72, pl. 118, fig. 6.
Ozarkodina delicatula Youngquist and Downs, 1949, pp. 168–169, pl. 30, figs. 1, 3, 7, 11.
Not *Bryantodus delicatus* Branson and Mehl, 1933, p. 222, pl. 16, fig. 19.
Not *Bryantodus delicatus* Beckmann, 1949, p. 161, pl. 1, fig. 7; pl. 3, fig. 3.

Synprioniodina component:

Synprioniodina microdenta Ellison, 1941
Synprioniodina sp. Gunnell, 1933, p. 269, pl. 31, fig. 6.
S. microdenta Ellison, 1941, p. 119, pl. 20, figs. 43–46.
S. microdenta Ellison and Graves, 1941, p. 3, pl. 1, fig. 10.

Idiognathodus-Streptognathodus component:

The following "species" of polygnathids have been extracted and identified from more or less complete assemblages.

Streptognathodus elegantulus Stauffer and Plummer, 1932
S. elegantulus Stauffer and Plummer, 1932, p. 47, pl. 5, figs. 6, 7, 22, 27.
Polygnathus pawhuskensis Harris and Hollingsworth, 1933, pp. 199–200, pl. 1, figs. 12a, b.
S. elegantulus Ellison, 1941, p. 127, pl. 22, figs. 1–6, 10.
S. elegantulus Stubblefield, 1945, p. 47.
Streptognathodus excelsus Stauffer and Plummer, 1932
S. excelsus Stauffer and Plummer, 1932, p. 48, pl. 4, figs. 2, 5.
S. increbescens Stauffer and Plummer, 1932, p. 49, pl. 4, figs. 9, 5, 16.
S. multinodosus Gunnell, 1933, p. 280, pl. 31, fig. 11.
S. clavatulus Gunnell, 1933, p. 280, pl. 31, fig. 9.
S. subdivisis Gunnell, 1933, p. 281, pl. 32, fig. 16.
S. minutus Gunnell, 1933, p. 282, pl. 32, fig. 65.
S. chanutensis Gunnell, 1933, p. 282, pl. 32, figs. 66–68.
S. clarki Gunnell, 1933, p. 283, pl. 33, fig. 3.
S. excelsus Ellison, 1941, p. 130, pl. 22, figs. 15, 17, 20.
Streptognathodus cf. *S. sulcatus* Gunnell, 1933
S. sulcatus Gunnell, 1933, p. 281, pl. 32, fig. 10.

S. ruidus Gunnell, 1933, p. 281, pl. 32, fig. 17.
S. sulcatus Ellison, 1941, p. 130, pl. 22, figs. 8, 12.

Streptognathodus gracilis Stauffer and Plummer, 1932
S. gracilis Stauffer and Plummer, 1932, p. 48, pl. 4, figs. 12, 13.
S. holmesi Gunnell, 1933, p. 280, pl. 32, figs. 1, 2.
S. sulciferous Gunnell, 1933, p. 281, pl. 32, fig. 12.
S. corrugatus Gunnell, 1933, p. 281, pl. 32, fig. 13.
S. rugosus Gunnell, 1933, p. 282, pl. 32, fig. 18.
S. curvatus Gunnell, 1933, p. 283, pl. 33, fig. 1.
S. gracilis Ellison, 1941, pp. 128–29, pl. 22, figs. 7, 11.
S. gracilis Stubblefield, 1945, p. 47.

Streptognathodus cancellosus (Gunnell)
Idiognathodus cancellosus Gunnell, 1933, p. 270, pl. 31, fig. 10.
I. regulatus Gunnell, 1933, p. 272, pl. 31, fig. 24.
I. binodosus Gunnell, 1933, p. 274, pl. 31, fig. 35.
I. biliratus Gunnell, 1933, p. 276, pl. 31, fig. 59.
I. symmetricus Gunnell, 1933, p. 276, pl. 32, fig. 3.
I. simplex Gunnell, 1933, p. 277, pl. 32, fig. 24.
Streptognathodus cancellosus Ellison, 1941, pp. 131–32, pl. 22, figs. 23, 26.
S. cancellosus Graves and Ellison, 1941, p. 3, pl. 3, fig. 18.

Streptognathodus cf. *S. eccentricus* Ellison, 1941
S. eccentricus Ellison, 1941, pp. 132–33, pl. 22, fig. 24.

Streptognathodus cf. *S. elongatus* Gunnell, 1933[1]
S. elongatus Gunnell, 1933, p. 283, pl. 33, fig. 30.
S. simplex Gunnell, 1933, p. 285, pl. 33, fig. 40.
S. elongatus Ellison, 1941, pp. 130–131, pl. 22, fig. 9.

Idiognathodus magnificus Stauffer and Plummer, 1932
I. magnificus Stauffer and Plummer, 1932, p. 46, pl. 4, figs. 8, 18, 20 only.
I. pustulata Harris and Hollingsworth, 1933, p. 204, pl. 1, fig. 11.
I. cuneiformis Gunnell, 1933, p. 270, pl. 31, fig. 8.
I. harkeyi Gunnell, 1933, p. 270, pl. 31, fig. 11.
I. siculus Gunnell, 1933, p. 271, pl. 31, fig. 14.
I. sulciferous Gunnell, 1933, p. 271, pl. 31, fig. 16.
I. clavatus Gunnell, 1933, p. 271, pl. 31, fig. 19.
I. ruidus Gunnell, 1933, p. 272, pl. 31, fig. 25.
I. megistus Gunnell, 1933, p. 273, pl. 31, fig. 30.
I. cicatricosus Gunnell, 1933, p. 274, pl. 31, fig. 34.
I. wintersetensis Gunnell, 1933, p. 274, pl. 31, figs. 36, 51.
I. strigillatus Gunnell, 1933, p. 274, pl. 31, fig. 37; pl. 32, fig. 8.
I. fusiformis Gunnell, 1933, p. 276, pl. 31, fig. 49.
I. vadosus Gunnell, 1933, p. 275, pl. 31, fig. 45.
I. erodus Gunnell, 1933, p. 275, pl. 31, fig. 48.
I. walteri Gunnell, 1933, p. 277, pl. 32, fig. 9.
I. magnificus Ellison, 1941, pp. 135–136, pl. 23, figs. 2, 3, 6, 9.
I. magnificus Ellison and Graves, 1941, p. 2, pl. 3, figs. 25–27.
I. cf. *I. gomphus* Youngquist and Downs, 1949, p. 167, pl. 31, figs. 14–15.

Specimens representing the following "species" have also been collected from the black shale below the LaSalle limestone, the zone from which DuBois collected his assemblages. It seems highly probable that these polygnathids represent components of this same natural species, although they have not yet been found in their original position in such assemblages.

Streptognathodus cf. *S. wabaunsensis* Gunnell, 1933
S. wabaunsensis Gunnell, 1933, p. 285, pl. 33, fig. 32.
S. walteri Gunnell, 1933, p. 284, pl. 33, fig. 31.
S. acuminatus Gunnell, 1933, p. 285, pl. 33, fig. 33.
S. farmeri Gunnell, 1933, p. 285, pl. 33, fig. 34.
S. flangulatus Gunnell, 1933, p. 284, pl. 33, fig. 35.
S. wabaunsensis Ellison, 1941, p. 131, pl. 22, figs. 19, 21, 22.

Streptognathodus oppletus Ellison, 1941.
Idiognathodus multinodosus Gunnell, 1933, p. 279, pl. 33, fig. 5.
S. oppletus Ellison, 1941, p. 132, pl. 22, figs. 13, 14, 16.

Streptognathodus cf. *S. simulator* Ellison, 1941
S. simulator Ellison, 1941, p. 133, pl. 22, figs. 25, 27–30.

This is a tentative identification. The species has not been previously recorded from beds of this age.

Idiognathodus acutus Ellison, 1941
I. acutus Ellison, 1941, p. 137, pl. 23, figs. 21, 24, not figs. 22, 25.
I. acutus Branson, 1944, p. 325.

[1] It is difficult to distinguish this species from *S. gracilis*, the only apparent difference being in their relative lengths. Although *S. elongatus* is at present recorded only from upper Virgil beds (Ellison, 1941), the present specimens seem to be more closely related to that species.

Idiognathodus cf. *I. acutus* Youngquist and Downs, 1949, p. 166, pl. 30, figs. 30, 31.

This species has been previously recorded only from the Des Moines Series.

Idiognathodus cf. *I. antiquus* Stauffer and Plummer, 1932

I. antiquus Stauffer and Plummer, 1932, p. 44, pl. 4, fig. 17.
I. porcatus Gunnell, 1933, p. 272, pl. 31, fig. 21.
I. chiriformis Gunnell, 1933, p. 272, pl. 31, fig. 23.
I. liratus Gunnell, 1933, p. 273, pl. 31, fig. 27.
I. corrugatus Gunnell, 1933, p. 277, pl. 32, fig. 7 only.
I. antiquus Ellison, 1941, p. 136, pl. 23, figs. 1, 7, 18, not figs., 8, 19.
I. iowaensis Youngquist and Heezen, 1948, p. 770, pl. 118, figs. 8, 4, 17, 18.

Idiognathodus claviformis Gunnell, 1931

I. claviformis Gunnell, 1931, p. 249, fig. 21 only.
I. claviformis Stauffer and Plummer, 1932, p. 45.
I. fustiformis Gunnell, 1933, p. 269, pl. 31, fig. 7.
I. nodostriatus Gunnell, 1933, p. 272, pl. 31, fig. 20.
I. claviformis Ellison, 1941, p. 137, pl. 23, figs. 12–17, 19, 20, 22, not figs. 18, 21, 23.
I. claviformis Branson and Mehl, in Shimer and Shrock, 1944, p. 246.
I. claviformis Ellison, in Branson, 1944, p. 325.
I. claviformis Youngquist and Heezen, 1948, p. 769, pl. 118, figs. 19, 20.
I. bellatulus Youngquist and Downs, 1949, p. 166, pl. 31, figs. 1–3, 19–21.

Idiognathodus delicatus Gunnell, 1931

I. delicatus Gunnell, 1931, p. 250, pl. 29, figs. 23–25.
I. delicatus Stauffer and Plummer, 1932, p. 45, pl. 4, figs. 4, 21, 24–26.
I. magnificus Stauffer and Plummer, 1932, p. 46, pl. 4, fig. 19 only.
I. modulatus Gunnell, 1933, p. 271, pl. 31, fig. 15.
I. spathodus Gunnell, 1933, p. 273, pl. 31, fig. 28.
I. semipapulatus Gunnell, 1933, p. 273, pl. 31, figs. 29, 50.
I. lanceolatus Gunnell, 1933, p. 273, pl. 31, figs. 31, 32.
I. folium Gunnell, 1933, p. 274, pl. 31, fig. 33.
I. gemmiformis Gunnell, 1933, p. 274, pl. 31, fig. 44.
I. warei Gunnell, 1933, p. 279, pl. 32, figs. 59–61.
I. kansensis Gunnell, 1933, p. 279, pl. 32, figs. 62–64.
I. cherryvalensis Gunnell, 1933, p. 277, pl. 32, fig. 5.
I. corrugatus Gunnell, 1933, p. 277, pl. 32, fig. 6 only.
I. delicatus Ellison, 1941, pp. 134–35, pl. 22, figs. 31–36.
I. delicatus Ellison and Graves, 1941, p. 2, pl. 3, figs. 20, 23.
I. delicatus Stubblefield, 1945, p. 47.

Genus DUBOISELLA Rhodes, n. gen.

Diagnosis.—Natural conodont assemblages consisting of paired conodonts of the "form genera" *Ligonodina*, *Lonchodina*, *Hibbardella*, *Metalonchodina*, and *Prioniodus*.

Description.—The genus is at present represented by only one species, in which the components appear to be two pairs of *Ligonodina*, two pairs of *Lonchodina*, one pair of *Hibbardella*, one pair of *Metalonchodina*, and one pair of *Prioniodus*. It may, therefore, be that the genus is characterized by similar numbers of the various components, although further collecting will be needed before any conclusion may be reached.

Type species.—*Duboisella typica* Rhodes, n. sp.

Geological range.—The range of this genus would appear to be limited by the "form genus" *Metalonchodina*, which ranges from the Chester to the Wolfcamp. The other generic components, however, have somewhat greater time ranges and all extend down into the Upper Devonian. It is possible, therefore, that broadly similar assemblages may prove to be present in these older strata. The ranges of the individual components are more fully discussed on page 898.

DUBOISELLA TYPICA Rhodes, n. sp.
Plate 128, figs. 1–6

Unnamed "atypical" assemblages. DUBOIS, 1943, p. 156, pl. 25, figs. 15, 19 only.

Material.—Two assemblages from black shale below LaSalle limestone, Loc. 1.
One assemblage from black shale above Coal No. 1, Loc. 4.
One assemblage from black shale of St. David formation, Loc. 5.
Nine assemblages from black shale above Coal No. 10, Loc. 2.

Diagnosis.—Natural conodont assemblages made up of two pairs of *Ligonodina*, two pairs of *Lonchodina*, one pair of *Hibbardella*, one pair of *Metalonchodina*, and one

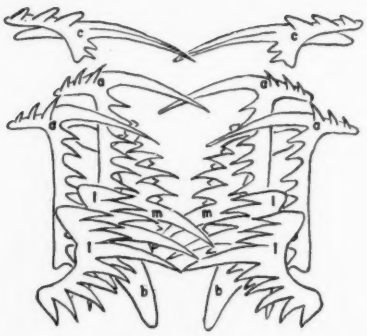


FIG. 3—*Duboisella typica* Rhodes, n. gen., n. sp. Diagrammatic representation to illustrate the general form and number of the individual components. The relative arrangement of the component conodonts is purely diagrammatic. *a*, *Ligonodina* component; *b*, *Prioniodus* component; *c*, *Hibbardella* component; *l*, *Lonchodina* component; *m*, *Metalonchodina* component. Approximately ×15.

pair of *Prioniodus*. The arrangement of the components is uncertain but it probably resembles the diagrammatic arrangement shown in Fig. 3.

Description:

Ligonodina component.—Posterior bar long, straight in a vertical and in a horizontal plane, slender; lateral faces flat or gently convex, wider at its base; aboral surface excavated by a shallow, longitudinal depression; the aboral margin very feebly outflexed, giving an insignificant aboral ledge. Fang elongated, stout, bluntly pointed tip, recurved inward, and posteriorly, the curvature being greatest near its base; outer lateral face strongly convex; inner lateral face flat, or very feebly convex, with a sharp posterior edge and a sharp antero-inner carina, so that fang has the appearance of being twisted in a vertical plane; the posterior basal portion of the fang is flattened, having feeble longitudinal ridges developed; the angle between the base of the fang and the posterior bar filled by lateral laminae, the outer of which is very convex, and the inner flatter, both having a slightly irregular aboral margin; aboral surface excavated by small cup-like cavity. Anterior aboral process strongly developed, making almost a right-angle with the posterior bar in a horizontal plane and an angle of about 135° with the fang in a vertical plane, its aboral surface excavated by an inconspicuous longitudinal depression; oral surface bearing a series of long, pointed denticles, laterally compressed, having gently convex anterior and posterior faces and sharp edges, decreasing in length towards the distal end of the process; gently recurved inwards and posteriorly; denticles of posterior bar, up to sixteen in number, discrete, slender, pointed, inclined posteriorly, gently convex lateral faces, sharp anterior and posterior edges, those in the median portion of the bar tending to be the longest.

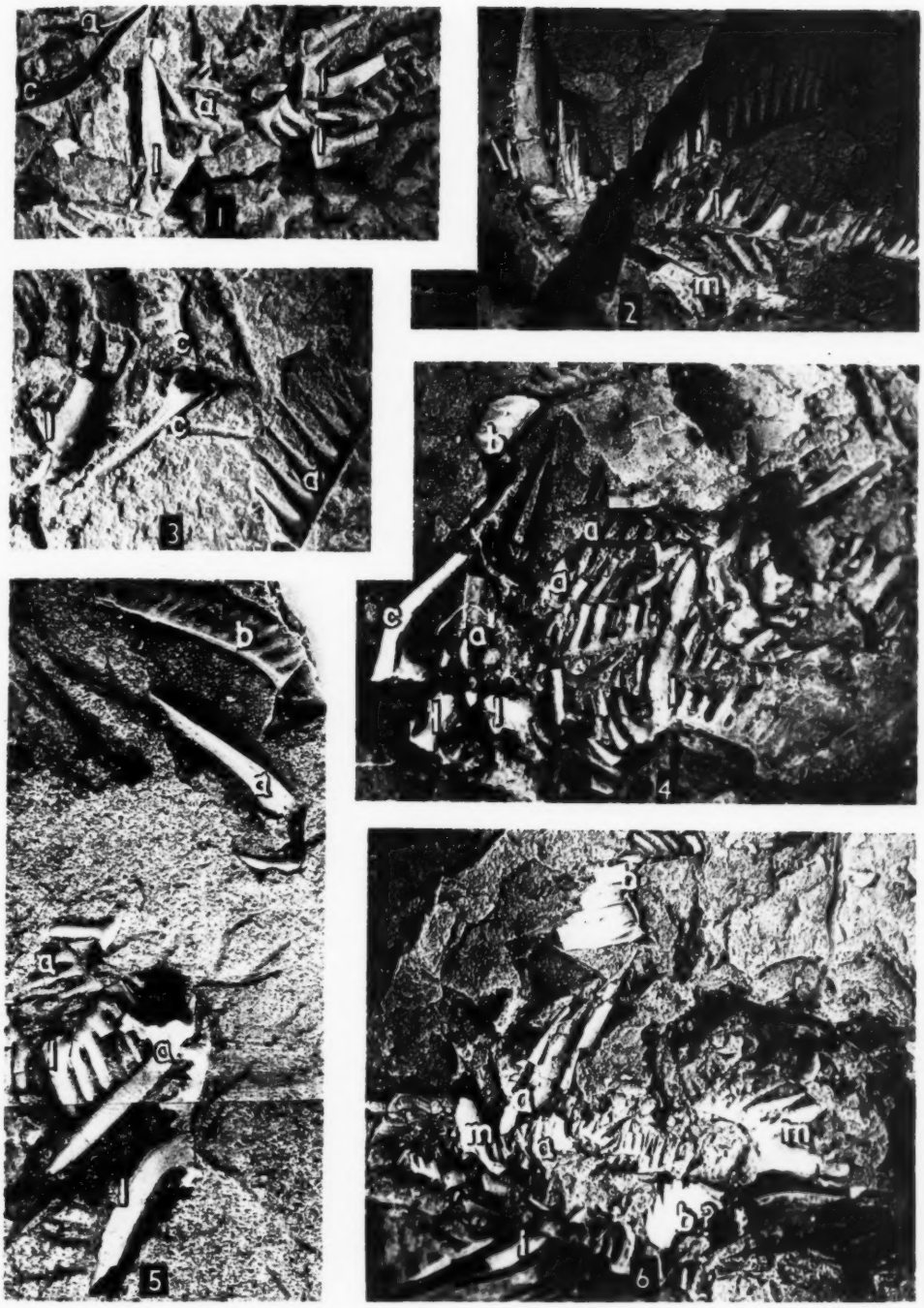
Lonchodina component.—Apical denticle greatly elongated, slender, laterally compressed, especially in its higher portion, with convex lateral faces and sharp anterior and posterior edges, the outer face tending to be more convex than the inner; recurved posteriorly and flexed gently inwards, the most conspicuous curvature being just above the base; base uniformly expanded. Basal bars thick, subequal in length, deep, strongly arched in a vertical plane below the apical denticle, the terminal portions tending to be almost straight; the anterior bar flexed inwards in a horizontal plane. Anterior limb bearing up to eight discrete, slender, pointed denticles, increasing in size posteriorly and recurved parallel to the apical denticle, exhibiting convex lateral faces and sharp anterior and posterior edges. Posterior limb

---

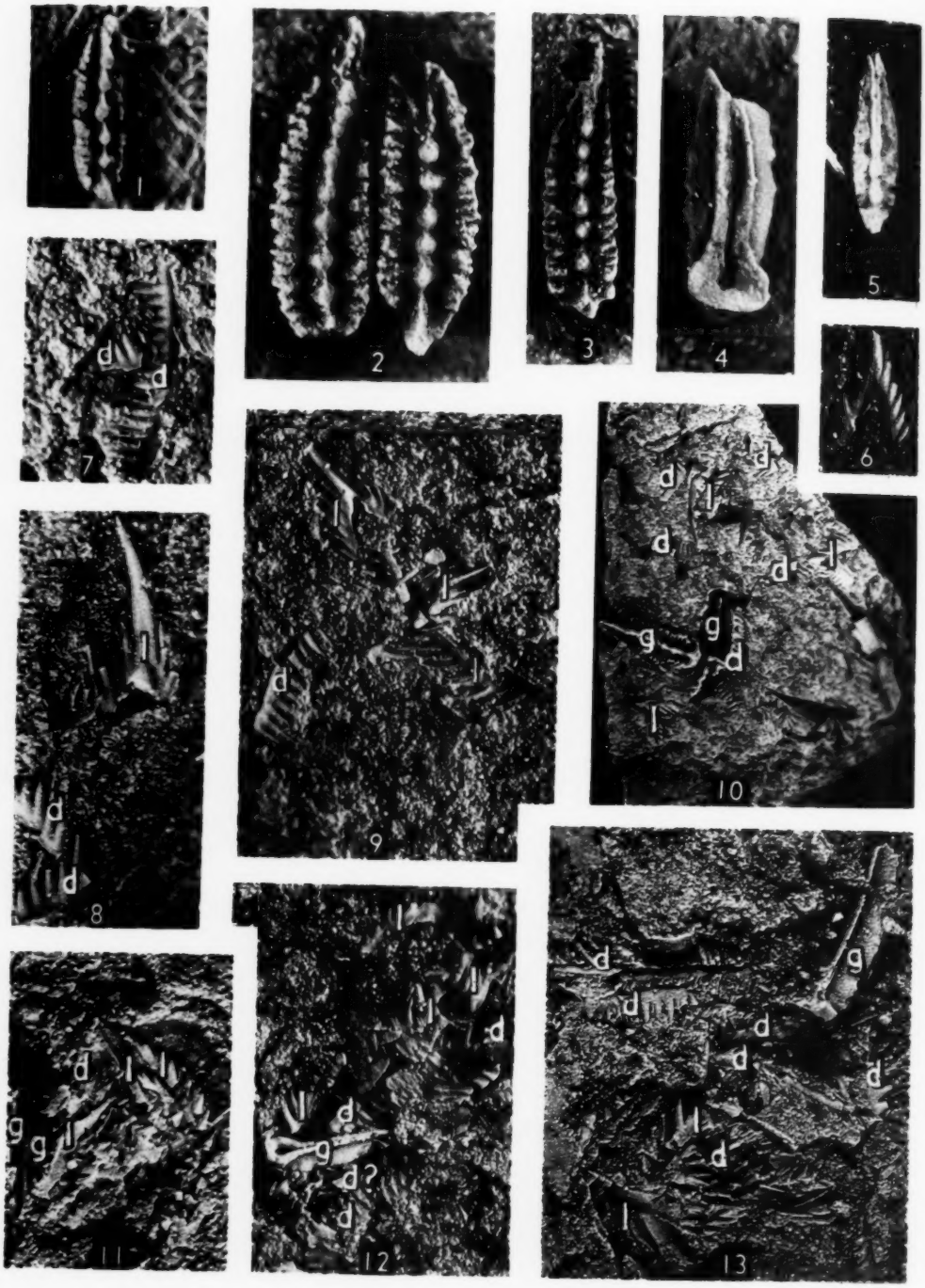
EXPLANATION OF PLATE 128

Duboisella typica Rhodes, n. gen., n. sp. (p. 895)

FIGS. *1–6*—Typical assemblages, with components marked as follows: *l* = *Lonchodina*, *a* = *Ligonodina*, *b* = *Prioniodus*, *m* = *Metalonchodina*, *c* = *Hibbardella*. *1*, paratype, X-1494, Loc. 2; *2*, paratype, X-1498, Loc. 4; *3*, paratype, X-1497, Loc. 5; *4*, holotype, X-1493, Loc. 1; *5*, paratype, X-1494, Loc. 1; *6*, paratype, X-1495, Loc. 2. Specimens shown in figs. *4*, *5* are from black shale below LaSalle limestone, Loc. 1; specimens shown in figs. *1*, *6* are from black shale above Coal No. 10, Loc. 2; specimen shown in fig. *2* is from black shale above Coal No. 1, Loc. 4; and specimen shown in fig. 3 is from black shale of St. David formation, Loc. 5, Figs. *1*, *3–6* ×24; *2* ×36. Note: In fig. *2*, only, *l* = *Ligonodina*.



Rhodes, Pennsylvanian Conodonts



Rhodes, Pennsylvanian Conodonts

bearing up to eight sub-equal, discrete, slender, pointed denticles, erect, or nearly so, to surface of bar, sub-parallel to apical denticle, the most posterior, however, being curved slightly anteriorly; gently convex lateral faces, sharp anterior and posterior edges. Base of limbs expanded, giving a broad aboral surface, which is excavated longitudinally by a thin shallow groove.

Hibbardella component.—Well preserved *Hibbardella* components are rare in the present collection but those available for study appear to be similar to those included in the species *H. subacoda* (Gunnell) by Ellison (1941). There are, however, a few minor differences between the two. The low median carina of the posterior groove on the apical denticle (reported by Ellison, 1941, p. 118) has not been observed in any of the specimens studied. The lateral bars are straight in the majority of specimens but in one (pl. 128, fig. 3) their distal portions are downflexed. Each lateral bar bears up to seven denticles on its oral surface.

Metalonchodina component.—The specimens of *Metalonchodina* found in the present assemblages appear very similar to those figured by Ellison (1946, pl. 20, figs. 35, 36) and referred by him to the species *M. bidentata* Branson and Mehl. It will, however, be noted that Ellison's specimens are not exactly similar, differing from one another in the distance between the denticles, and also appearing to differ from Branson and Mehl's hypotype in the degree of arching of the bar in a vertical plane. The present specimens, although showing a similar variation in the distance between the denticles and the degree of arching of the bar, are included within the specific description given by Branson and Mehl. Ellison distinguishes *M. bidentata* from the species *M. tenora* by the development of only one denticle on the anterior limb and the discrete nature of the denticles in the former species. Some of the present specimens, however, appear to approach *M. tenora* in their semi-coalesced denticles and further collecting may prove that the two species are synonymous, representing the normal extent of variation in a single component of a natural assemblage.

Prioniodus component.—Specimens from the present assemblages are similar to those illustrated both by Gunnell and Ellison under the species *P. conjunctus*. The posterior bar may bear up to fourteen denticles on its oral surface, the posterior portion of the bar being almost straight in a vertical plane. The flaring of the aboral surface of the inner face of the anterior fang is conspicuous in all specimens studied, and the anterior and posterior edges of the outer lateral face of the fang are flattened, the median portion being broadly convex transversely. The posterior bar is expanded just below the base of the denticles on the inner face, giving a longitudinal ledge-like ridge; the aboral surface of the bar is flat or broadly rounded, with a feeble longitudinal groove.

Holotype.—University of Illinois, No. X-1493. From black shale below LaSalle limestone, Loc. 1.

Paratypes.—University of Illinois, Nos. X-1494–1498.

Discussion.—A study of the various components suggests that they represent the following species.

Ligonodina component:

Ligonodina typa (Gunnell)
Idioprioniodus typus Gunnell, 1933, p. 265, pl. 31, fig. 47.

EXPLANATION OF PLATE 129

Illinella typica Rhodes, n. gen., n. sp. (p. 899).

FIGS. *1–5*—*Gondolella* components. *1*, *G. curvata* Stauffer and Plummer, oral view, X-1500-10; *2*, pair of *G. curvata* Stauffer and Plummer, extracted from same assemblage, oral view X-1450-3; *3*, *G.* cf. *G. curvata* Stauffer and Plummer, oral view, X-1500-1; *4*, *Gondolella* sp., aboral view of broken specimen, X-1580-4; *5*, *G.* cf. *G. bella* Stauffer and Plummer, oral view of immature (?) specimen, X-1500-11.

6—*Lonchodina* component. "Inner lateral" view, X-1501.

7—*Lonchodus* components, lateral view, X-1502.

8–13—Assemblages of *Illinella typica*, with components marked as follows: *g*=*Gondolella*, *l*=*Lonchodina*, *d*=*Lonchodus*. *8*, paratype X-1503; *9*, paratype, X-1504; *10*, paratype, X-1507; *11*, paratype, X-1506; *12*, paratype, X-1508; *13*, holotype, X-1505.

All specimens from black shale above coal No. 2 (?), Loc. 7. Figs. *1–6* ×36; *7–9*, *11–13* ×24; *10* ×15.

Prioniodus? galesburgensis Gunnell, 1933, p. 267, pl. 31, fig. 12.
Ligonodina typa Ellison, 1941, pp. 114–15, pl. 20, figs. 8–11.
Lonchodus ? sp. Youngquist and Heezen, 1948, p. 771, pl. 118, fig. 12.

Lonchodina component:

Lonchodina clarki (Gunnell)
Prioniodus clarki Gunnell, 1931, p. 247, pl. 29, fig. 8.
Prioniodus cornutus Stauffer and Plummer, 1932, p. 27, pl. 13, fig. 23.
Prioniodus clarki Stauffer and Plummer, 1932, p. 27, pl. 3, figs. 27, 28.
Lonchodina clarki Ellison, 1941, p. 116, pl. 20, figs. 21, 27, 30, 31.
L. clarki Ellison and Graves, 1946, p. 3, pl. 1, figs. 15, 22.
cf. *Prioniodina ? obtusa* Ellison, 1941, p. 119, pl. 20, figs. 12, 17.
cf. *Ligonodina ? abbreviata* Youngquist and Heezen, 1948, p. 770, pl. 118, fig. 11.

Hibbardella component:

Hibbardella cf. *H. subacoda* (Gunnell)
Prioniodus subacodus Gunnell, 1931, p. 246, pl. 29, fig. 5.
Prioniodus missouriensis Gunnell, 1931, p. 246, pl. 29, fig. 9.
Idioprioniodus striatus Gunnell, 1933, p. 265, pl. 32, figs. 36, 37.
Hibbardella subacoda Ellison, 1941, p. 118, pl. 20, figs. 22, 26.
Trichognathus subacoda Ellison and Graves, 1941, p. 3, pl. 1, fig. 19.
Hibbardella subacoda Youngquist and Heezen, 1948, pp. 768–69, pl. 118, fig. 13.

Metalonchodina component:

Metalonchodina bidentata (Gunnell)
Prioniodus bidentatus Gunnell, 1931, p. 247, pl. 29, fig. 6.
Prioniodus dactylodus Gunnell, 1933, p. 265, pl. 31, fig. 1.
Metalonchodina bidentata Branson and Mehl, 1941, p. 106, pl. 19, fig. 34.
M. bidentata Ellison, 1941, p. 116, pl. 20, figs. 35, 36.

Prioniodus component:

Prioniodus conjunctus Gunnell, 1931
P. conjunctus Gunnell, 1931, p. 247, pl. 29, fig. 7.
P. cacti Gunnell, 1933, p. 276, pl. 31, figs. 4, 5.
Prioniodus sp. Gunnell 1933, p. 267, pl. 32, fig. 32.
P. conjunctus Ellison, 1941, pp. 113–14, pl. 20, figs. 1–3, 16.
P. conjunctus Gunnell, in Branson, 1944, p. 327.
P. cacti Youngquist and Downs, 1949, p. 169, pl. 30, figs. 16, 17.

Geological range.—Ellison (1941, p. 111) has shown in his studies in the Pennsylvanian of Kansas and Missouri that *Ligonodina typa* and *Lonchodina clarki* both range from the middle Cherokee to the top of the Pennsylvanian, *Hibbardella subacoda* from the lower Cherokee to the lower Shawnee, *Metalonchodina bidentata* through the Des Moines Series, and *Prioniodus conjunctus* from the middle Cherokee to the middle Shawnee. It therefore appears that this particular assemblage has a stratigraphical range which is limited by the *Metalonchodina* component. Broadly similar assemblage (representing different biological species) may, however, be present at other horizons.

One of the most striking features of the individual components is their similarity to certain "form species" described from older formations; although it is not claimed that such forms are "conspecific," their general similarity is remarkable. The following Upper Devonian "form species" may be compared with components from the present assemblage: *Ligonodina falciformis* Ulrich and Bassler, *Lonchodina? projecta* Ulrich and Bassler, *Lonchodina? prona* Ulrich and Bassler, *Hibbardella angulata* (Hinde) Ulrich and Bassler, *Prioniodus alatus* Hinde. It will be noted that there is no Upper Devonian form comparable with *Metalonchodina*. The general similarity of other forms to the present components, however, suggests that the biological genus represented by this assemblage may have undergone relatively little change between the Upper Devonian and the Pennsylvanian.

Genus ILLINELLA Rhodes, n. gen.

Diagnosis.—Natural conodont assemblages consisting of paired conodonts of the "form genera" *Gondolella*, *Lonchodus* (*Centrodus*) and *Lonchodina*.

Description.—The genus is at present represented by only a single species in which the numbers of components are one pair of *Gondolella*, four pairs of *Lonchodus*, and two pairs of *Lonchodina*. This may indicate that the same numbers are typical of all members of the genus, but further collecting will be necessary before any definite conclusion may be reached.

Type species.—*Illinella typica* Rhodes, n. sp.

Discussion.—The name *Lonchodus* was proposed by Pander (1856, p. 31) to replace the preoccupied name *Centrodus* which he had given to a group of specimens, each of which consisted essentially of a straight, horizontal bar bearing a series of discrete, subequal denticles. It seems probable that these specimens, which showed considerable variation in form, represented the broken fragments of other genera. Subsequent workers (e.g. Ulrich and Bassler, 1926, p. 42) have suggested that the generic name "*Lonchodus*" be retained to describe imperfect or generically indeterminate material. A study of many specimens from the Pennsylvanian of Illinois suggests, however, that *Lonchodus* s.s. does, in fact, represent a distinct group of conodonts, which are not fragments of other genera.

Geological range.—The range of this genus is apparently limited by its *Gondolella* component which has been recorded from the lower Des Moines to the upper Wolfcamp (Ellison, 1946).

ILLINELLA TYPICA Rhodes, n. sp.
Plate 129, figs. 8–13

Material.—Twenty-one assemblages from black shale Coal No. 7, Loc. 7.

Diagnosis.—Natural conodont assemblages made up of one pair of *Gondolella*, four pairs of *Lonchodus* and two pairs of *Lonchodina*. Components are of the type described in detail below.

Description:

Gondolella component (Plate 129, figs. 1–5).—Specimens of this genus extracted from the present assemblages show appreciable variation in form and may be referred to a number of existing "form species." Other specimens included in the illustrations on Plate 129 have been collected from the same shale surfaces as the assemblages, although they have not been found in intimate association with them. It seems reasonable to assume that, since no other type of assemblage containing *Gondolella* has been found, these specimens represent dissociated components of similar assemblages.

Reference to Plate 129 will reveal that these components show the following variations. The platform varies from wedge-shaped to crescent-shaped to subelliptical in outline, the relative width, the point of maximum width, the shape of the anterior and posterior ends and the presence or absence of an accessory posterior lobe all being factors which influence this variation in outline. The depth of the platform in side view relative to the height of the blade is also variable, as is the depth and general outline of the aboral attachment scar. The ornamentation of the oral surface shows considerable variation. Such specimens as that illustrated in Plate 129, fig. 5, tend to suggest that the oral surface of some young forms may be plain,

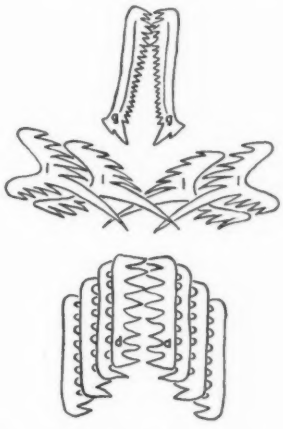


FIG. 4—*Illinella typica* Rhodes, n. gen., n. sp. Diagrammatic representation to illustrate the general form and number of the individual components. The relative arrangement of the component conodonts is purely diagrammatic. *d*, *Lonchodus* component; *g*, *Gondolella* component; *l*, *Lonchodina* component. Approximately ×15.

the development of crenulation being an adult feature. The oral ridges of the platform vary in their direction, length and sharpness. Some such ridges bifurcate near the outer edges of the platform, some extend only part of the way in towards the carina, becoming obsolescent as it is approached, while others produce a bevelling effect upon the margin of the platform. The cross section and length of the posterior denticle are also variable and an inconspicuous denticle may sometimes be developed behind the posterior denticle (cf. Ellison, 1941, p. 121, in remarks on *G. bella*).

The extent of this variation will be understood from a study of the original descrip-

tions of existing "form species" which are listed in "synonymy" in the discussion of this species.

Lonchodus component (Plate 129, fig. 7).—Since no existing "form species" appears similar to these components, a detailed description is given.

Elongated denticulated bars, usually straight but rarely down-curved in a vertical plane: laterally compressed so that lateral walls are flat or very feebly convex. Denticles up to seventeen in number, discrete, sharply pointed, two to three times as long as depth of bar, feebly convex lateral faces, sharp anterior and posterior edges, closely spaced, their bases being coalescent, usually straight but rarely recurved or slightly inclined posteriorly. Aboral surface excavated by a shallow longitudinal groove.

Lonchodina component (Plate 129, figs. 6, 8).—These components are not included in any existing species, and are, therefore, described in detail.

Slender dental units; anterior bar tending to be deeper than the posterior, both bars more or less straight but strongly flexed in a vertical plane at their union below the apical denticle; distal ends of both bars spatulate in form; both bars laterally compressed with one lateral face (the conventional "inner face") flat or very feebly convex, the other more strongly convex. Anterior bar bears as many as ten denticles on its oral surface; denticles discrete but their bases coalescent; laterally compressed, the faces on one side (the "inner") being flat or feebly convex, the opposing faces being more convex; sharp anterior and posterior edges; recurved so that they lie sub-parallel to the apical denticle. The posterior bar bears six or fewer denticles, similar in form to those of the anterior bar and lying sub-parallel to the apical denticle. Apical denticle elongated, slender, laterally compressed with one lateral face (the "inner") flat or feebly convex, the other more strongly convex; recurved posteriorly. Aboral surface of both bars excavated by a shallow longitudinal groove, which is continuous with an aboral pit below the apical denticle.

It will be noted that this form of *Lonchodina* differs from the *Lonchodina* component of *Duboisella typica* in its lack of a conspicuous aboral subapical flange, its lack of lateral bowing, and its more slender construction.

Holotype.—University of Illinois, No. X. 1505. From black shale below Coal No. 7, Loc. 7.

Paratypes.—University of Illinois, Nos. X. 1503, 1504, 1506–1508. From black shale below Coal No. 7, Loc. 7.

Discussion.—The following "form species" seem to be represented by the *Gondolella* components of these assemblages.

Gondolella curvata Stauffer and Plummer, 1932
- *G. curvata* Stauffer and Plummer, 1932, p. 42, pl. 3, figs. 13, 14, 17.
- *G. curvata* Ellison, 1941, pp. 123–124, pl. 21, figs. 25, 24, 33, 38, 39.

Gondolella magna Stauffer and Plummer, 1932
- *G. magna* Stauffer and Plummer, 1932, p. 43, pl. 3, figs. 6, 7, 10, 11.
- *G. magna* Ellison, 1941, p. 124, pl. 21, fig. 37.

Gondolella cf. *G. neolobata* Ellison, 1941
- *G. neolobata* Ellison, 1941, p. 125, pl. 21, figs. 28, 32.

Gondolella cf. *G. bella* Stauffer and Plummer, 1932
- *G. bella* Stauffer and Plummer, 1932, p. 42, pl. 3, figs. 3, 4.
- *G. minuta* Stauffer and Plummer, 1932, p. 44, pl. 3, figs. 1, 3.
- *G. bella* Ellison,[1] 1941, p. 121, pl. 21, figs. 6, 10, 14.

Geological range.—It is difficult to limit the stratigraphical range of the species *Illinella typica* since two of the components have not been described from other zones. The *Gondolella* components represented by the "form species" *G. neolobata* and *G. bella* have not previously been recorded from beds as young as those from which these assemblages were collected. The presence of *Gondolella* in the assemblage would appear, however, to indicate that the assemblage is confined to the Pennsylvanian and the Wolfcamp series of the Permian (Ellison, 1946).

LIST OF COLLECTING LOCALITIES

Loc. 1. Black shale below LaSalle limestone, SE ¼ of the NW¼, Sec. 6, T. 32 N., R. 1 E., about one and a half miles southeast of Oglesby, Illinois. Deep gorge where Bailey Creek enters Vermilion River.

Loc. 2. Black shale above Coal No. 10, SW¼ of the SE¼, Sec. 35, T. 10 N., R. 7 W., Macoupin County, Illinois. Ravine 100 feet east of State Highway 4.

[1] *G. bella* may represent an immature form of another species.

Loc. 3. Black shale above Coal No. 8, NE¼ of the SW¼, Sec. 20, T. 12 N., R. 9 W., Macoupin County, Illinois. Ravine about three-quarters of a mile west of Scottville.

Loc. 4. Black shale above Coal No. 1, NE¼ of the NW¼, Sec. 3, T. 16 N., R. 2 E., Henry County, Illinois. Exposure in stream section two miles east of Morristown.

Loc. 5. Black shale of St. David formation, SW ¼ of the NE¼, Sec. 9, T. 15 N., R. 3 E., Henry County, Illinois. Small ravines two miles east of Cambridge.

Loc. 6. Black shale above Coal No. 9, Pacific Mine, Kentucky.

Loc. 7. Black shale above Coal No. 2 (?), SE¼ of the SW¼, Sec. 9, T. 1 N., R. 6 W., Adams County, Illinois. Exposure in stream section.

REFERENCES

BECKMANN, VON HEINZ, 1949, Conodonten aus dem Iberger Kalk (Ober-Devon) des Bergischen Landes und Feinbau: Senckenbergiana, Band 30, Number 1/3, pp. 153–163.

BRANSON, E. B., 1944, The geology of Missouri: Missouri Univ. Studies, vol. 19, no. 3, pp. 1–535.

BRANSON, E. B., and MEHL, M. G., 1933, Conodont studies: University of Missouri Studies, vol. 8, nos. 1–4.

—— and ——, 1936, Geological affinities and taxonomy of conodonts (abstract): Pan-American Geologist, vol. 65, no. 3, p. 233; Proc. Geol. Soc. America, 1935, p. 436.

—— and ——, 1938, Conodont assemblages (abstract): Proc. Geol. Soc. America, 1937, p. 270.

—— and ——, 1941, New and little known Carboniferous conodont genera: Jour. Paleontology, vol. 15, pp. 98–106.

BRYANT, W. L., 1921, The Genesee conodonts: Bull. of the Buffalo Soc. of Natural Sciences, vol. 13, no. 2, pp. 1–59.

COOPER, C. L., 1945, A conodont assemblage from the lower Kinderhook black shales (Kentucky): Bull. Geol. Soc. America, vol. 56, p. 1153.

CULLISON, J. S., 1938, Dutchtown fauna of southeastern Missouri: Jour. Paleontology, vol. 12, pp. 219–228.

DEMANET, F., 1938, Filtering appendages on the branchial arches of *Coelacanthus lepturus* Agassiz: Geol. Mag., vol. 76, p. 215.

DUBOIS, E. P., 1941, Additional evidence on the origin of conodonts: Illinois Acad. Science Trans., vol. 34, p. 168.

——, 1943, Evidence on the nature of conodonts: Jour. Paleontology, vol. 17, pp. 155–159.

ELLISON, SAMUEL P., JR., 1941, Revision of the Pennsylvanian conodonts: Jour. Paleontology, vol. 15, pp. 107–143.

——, 1944, The composition of conodonts: Jour. Paleontology, vol. 18, pp. 133–140.

——, 1946, Conodonts as Paleozoic guide fossils: Bull. Amer. Assoc. Pet. Geol., vol. 30, pp. 93–110.

ELLISON, SAMUEL, and GRAVES, ROY W., JR., 1941, Lower Pennsylvanian (Dimple limestone) conodonts of the Marathon region, Texas: University of Missouri School of Mines and Metallurgy Bull., vol. 14, no. 3, pp. 1–21.

GUNNELL, F. H., 1931, Conodonts from the Fort Scott limestone of Missouri: Jour. Paleontology, vol. 5, pp. 244–250.

——, 1933, Conodonts and fish remains from the Cherokee, Kansas City and Wabaunsee groups of Missouri and Kansas: Jour. Paleontology, vol. 7, pp. 261–297.

HARRIS, R. W., and HOLLINGSWORTH, R. V., 1933, New Pennsylvanian conodonts from Oklahoma: Am. Jour. Sci., 5th ser., vol. 25, pp. 193–204.

HASS, WILBERT H., 1941, Morphology of conodonts: Jour. Paleontology, vol. 15, pp. 71–81.

HINDE, G. J., 1879, On conodonts from the Chazy and Cincinnati group . . . : Quart. Jour. Geol. Soc. of London, vol. 35, pp. 351–369.

JONES, D. J., 1938, Conodont fauna of the Seminole formation: Unpublished thesis, Dept. of Geology and Paleontology, University of Chicago.

PANDER, C. H., 1856, Monographie der fossilen fische des Silurischen Systems der Russisch-Baltischen governments: St. Petersburg, 91 pp.

SCHMIDT, HERMANN, 1934, Conodonten-Funde in ursprunglichen Zusammenhang: Paleont. Zeitschrift, Bd. 16, pp. 76–85.

SCOTT, H. W., 1934, Zoological relationships of the conodonts: Jour. Paleontology, vol. 8, pp. 448–455.

——, 1942, Conodont assemblages from the Heath formation, Montana: Jour. Paleontology, vol. 16, pp. 293–300.

SHIMER, H. W., and SHROCK, R. R., 1944, Index fossils of North America. The Technology Press, John Wiley, New York.

STAUFFER, C. R., and PLUMMER, HELEN J., 1932, Texas Pennsylvanian conodonts and their stratigraphic relations: Texas University Bull., no. 3201, pp. 13–50.

STUBBLEFIELD, C. J., 1945, Systematic palaeontology *in* MITCHELL, G. H., The geology of the northern part of the South Staffordshire coal field: Geol. Surv. Great Britain, Wartime Pamphlet, No. 43.

ULRICH, E. O., and BASSLER, R. S., 1926, A classification of the toothlike fossils, conodonts, with descriptions of American Devonian and Mississippian species: Proc. U. S. Nat. Museum, vol. 68, art. 12, pp. 1–63.

YOUNGQUIST, W., and DOWNS, R. H., 1949, Additional conodonts from the Pennsylvanian of Iowa: Jour. Paleontology, vol. 23, pp. 161–171.

YOUNGQUIST, W., and HEEZEN, B. C., 1948, Some Pennsylvanian conodonts from Iowa: Jour. Paleontology, vol. 22, pp. 2767–773.

JOURNAL OF PALEONTOLOGY, VOL. 26, NO. 6, PP. 902–914, PLS. 130–131, 14 TEXT FIGS., NOVEMBER 1952

OSTRACODE GENUS *CYTHERIDEIS* AND ITS ALLIES

HARBANS SINGH PURI
Louisiana State University, Baton Rouge, Louisiana

ABSTRACT—Detailed study of the genus *Cytheridеis* shows *Cythere botellina* Jones to be its valid genotype. *C. anderseni* and *C. wilberti* are identified for the first time from the Miocene of the Gulf Coast. Analysis of the species of *Cytheridеis* shows several species restricted to various formations in the American Cenozoic. A chart, based on examination of 41 localities, shows their stratigraphic range. The new subfamily Cytheridеisinae includes *Cytheridеis* and related genera *Pontocythere*, *Copytus*, *Krithe*, and *Cushmanidea*. Two new genera, *Sahnia* and *Neocytheridеis*, reported from the Recent of South England, also belong to this subfamily.

INTRODUCTION AND HISTORY OF THE GENUS

THE genus *Cytheridеis* was described by Jones in 1857 as a subgenus of *Cythere*. Later it was raised to generic rank by Brady (1868, p. 454). Jones (1857, p. 46) gave the following description of the genus based on ten species listed in this order: *C. trigonalis* Jones; *C. tuberculata*, n. sp.; *C. unisulcata* Jones; *C. unicornis* Jones, *C.* (*?*) sp.; *C. tamarindus*, n. sp.; *C. colwellensis*, n. sp.; *C. bartonensis*, n. sp.; *C. flavida* Müller; and *C. ren*, n. sp.

"Animal a *Cythere?* Carapace more or less triangular; surface smooth, pitted or tuberculate; hinge margin simple, except that the central position of the dorsal margin of the left valve being somewhat incurved under that of the right valve (when they are closed), the anterior and posterior angles of the dorsal margin of the left valve remain somewhat projecting, and they present internal shallow furrows for the reception of the corresponding angles of the opposite valve; ventral margin partially curved.

"This is a more distinct form of the hingement that generally obtains in *Cypris*."

Jones did not designate a genotype.

It is evident from Jones' description and figures that he dealt with several different genera. Following the researches of Sars, Brady, Robertson, and others on the relationships of the Recent genera and species, Jones (1870) and Jones and Sherborn (1889) revised these forms and regrouped them under various genera in accordance with the classification adopted by Brady.

C. trigonalis, the first of the ten species described by Jones, was designated as the genotype of *Cytheridеis* by Van den Bold (1946, p. 27). Van den Bold somehow ignored two important papers by Jones and Sherborn (1887, p. 587; 1889, p. 11) in which they gave notice of the transfer of this species to the genus *Potamocypris* Brady. Since the author eliminated this species from the genus *Cytheridеis*, it cannot be considered as its genotype. *C. tuberculata* Jones, the second species described by Jones, likewise was assigned to *Potamocypris* Brady (Jones and Sherborn 1889, p. 11). The generic determination of the third species, *C. unisulcata* Jones, was considered doubtful by Jones and Sherborn (1889, p. 46) who thought that it might be a young *Cypridea spinifera* or possibly a *Metacypris*. The generic characters of the fourth species, *C. unicornis* Jones, were considered to be doubtful by Jones (1870, p. 157). The fifth species, *C.* (*?*) sp. was tentatively referred to the genus *Cytheridеis* (Jones 1857, p. 49). The sixth species, *C. tamarindus* Jones, is the genotype of *Loxoconcha* Sars (Brady 1868, p. 435; Jones 1870, p. 157; Jones and Sherborn 1889, p. 42). Jones (1870, pp. 157, 159) thought the seventh species, *C. colwellensis* Jones, is "not a true *Cytheridеis*." Jones and Sherborn (1889, p. 45) retained this species in *Cytheridеis* but their illustrations of it suggest that it should be classified as *Cytheretta* Müller. The eighth species, *C. bartonensis* Jones, was grouped under *Ilyobates* by Jones (1870, p. 157) and was later designated the genotype of *Krithe* by Brady, Crosskey, and Robertson (1874, p. 184).

The ninth species, *C. flavida* Müller, according to Brady (1868, p. 454), differs

materially from the Crag species reported by Jones (1857, p. 50) under that name. Brady assumed that it was the same as *C. flavida* Müller of Baird which likewise was not O. F. Müller's species. Brady (1868, p. 454) therefore renamed and redescribed Baird's *C. flavida* as *C. subulata* Brady, new name. Jones' (1857, pp. 50, 51, pl. 4, figs. 4a–4c) species was not the same as Baird's *C. flavida* which was renamed *C. subulata* by Brady. Jones (1870, p. 157) therefore proposed for the Crag species another new name, *C. botellina*.

Brady and Norman (1889, p. 226) designated *C. subulata* as genotype of *Cytherideis*, but, as noted by Jones (1870, p. 157), Brady's form is different from that of the Crag and therefore cannot be accepted as genotype. The genotype must be *C. botellina* Jones (1870).

Sylvester-Bradley (1946) considered the designation by Brady and Norman (1889) of *C. subulata* (new name for *Cythere flavida* Baird, 1850, not Müller, 1785) as genolectotype of *Cytherideis* to be invalid. In his opinion this designation could not be considered valid unless ratified by the International Commission on Zoological Nomenclature. The International Commission is therefore being asked by Dr. J. P. Harding and P. C. Sylvester-Bradley (P. C. Sylvester-Bradley, personal communication, February, 1952) to use plenary powers to validate the otherwise invalid choice of Brady and Norman (1889), i.e. *Cytherideis subulata* (Brady). The effect of such a decision, according to Sylvester-Bradley, would be to preserve the name *Cytherideis* in the sense in which it has been used by neontologists and some paleontologists for the last eighty years. *C. subulata* Brady, as will be seen from the preceding discussion, is a rather unique form which least fits the description of *Cytherideis* as outlined by Jones (1857, p. 46).

There are at least two externally similar forms present in the area of the British Isles from whence Brady obtained his material. Shore sand at Swange, Dorset County, South England, collected by Arthur Earland and now in the Henry V. Howe collection, has yielded two externally similar forms with radically different interiors. These forms are here referred to two new genera, *Sahnia* and *Neocytherideis*.

A new subfamily, Cytherideisinae, is proposed for the reception of the genera *Cytherideis*, Jones; *Copytus* Skogsberg; *Krithe* Brady, Crosskey and Robertson; *Cushmanidea* Blake; *Pontocythere* Dubovsky; *Sahnia* Puri, n. gen.; and *Neocytherideis* Puri, n. gen.

Cytherideis has hitherto been placed in the subfamily Cytherinae Dana. The type genus of Cytherinae is *Cythere* O. F. Müller from which *Cytherideis* differs fundamentally in shape, hinge-structure, muscle-scar pattern, and other shell characteristics; and in the author's opinion the latter genus does not belong to the subfamily Cytherinae. *Cythere* is reniform in shape while *Cytherideis* is elongate. *Cythere* has a toxodont hinge which in the right valve bears two teeth, each subdivided into several cusps; *Cytherideis* on the other hand is toothless and the valves articulate by means of noncrenulate grooves and flanges. The muscle-scar pattern in *Cythere* consists of a group of five pits below which are two others, as compared with the vertical row of four muscle-scars behind an additional three scars in *Cytherideis*. The line of concrescence in *Cythere* departs from the inner margin slightly at the anterior end, whereas in *Cytherideis* it parallels the inner margin except on the anterior. All of these differences serve to separate *Cytherideis* and related genera from *Cytherinae* and together constitute a more natural and distinct subfamily, Cytherideisinae.

ACKNOWLEDGMENTS

Deep gratitude is expressed to Dr. Henry V. Howe, Director, School of Geology, Louisiana State University, for guiding this study, for the samples he furnished, and for access to his type collection and library. The author is indebted to Dr. Robert O. Vernon for the use of samples from western Florida, now in the Henry V. Howe collection. Appreciation is expressed to Miss Celia Helena Fajardo for assistance in preparation of plates and manuscript.

TYPES

All types are deposited in the Henry V. Howe type collection, Louisiana State University, Baton Rouge, Louisiana.

TABLE I.—CORRELATION OF MIOCENE SECTION OF WESTERN FLORIDA WITH THE SECTION USED IN THIS ARTICLE

Standard Section*					Section used in this article
MIOCENE	UPPER	Choctawhatchee formation		*Cancellaria zone*	*Cancellaria* zone†
				Ecphora zone	*Ecphora* zone†
	MIDDLE			*Arca* zone	Perimenter's farm beds
				Yoldia zone	*Arca* zone
					Yoldia zone
		ALUM BLUFF GROUP	Shoal River formation	*Cardium* bed	Lower beds at Spence farm
					Cardium bed
				Middle zone	Type Shoal River
				Type zone	Godwin Bridge beds
			Oak Grove sand	Transition zone	Upper Oak Grove
				Type zone	Type Oak Grove
	LOWER		Chipola formation	Chipola	Chipola
		Tampa formation		Tampa	Tampa

* Modified after Cushman and Ponton (1932). Most of the collections were made from localities described by them.

† Duplin marl of the Carolinas.

LOCALITIES

Listed below are the localities from which samples used were collected. References to locations contained in the text are indicated by the index number which precedes each entry.

1. Chipola. NE¼ NE¼ Sec. 20, T. 1 N., R. 16 W., Washington County, Florida.
2. Chipola. SE¼ SE¼ Sec. 8, T. 3 N., R. 16 W., Chimney quarry, Washington County, Florida.
3. Chipola. SE¼ SE¼ Sec. 5, T. 1 N., R. 16 W., Washington County, Florida.
4. Chipola. 1 mile below Scotts Bridge, NE¼ of Sec. 27, T. 2 N., R. 12 W., Bay County, Florida.
5. Chipola. In a ravine 200 yards east of Holmes Creek, NW¼ NE¼ Sec. 28, T. 2 N., R. 16 W., Washington County, Florida.
6. Chipola. 220 yards below Walsingham Bridge, NE¼ of Sec. 15, T. 1 N., R. 13 W., Washington County, Florida.
7. Chipola. 1 mile above Gainer's Bridge, NW¼ Sec. 34, T. 1 N., R. 13 W., Washington County, Florida.
8. Chipola. SE¼ SE¼ Sec. 5, T. 1 N., R. 16 W., Washington County, Florida.
9. Chipola. At Red Head Still, NE¼ NW¼ Sec. 20, T. 1 N., R. 16 W., Washington County, Florida.
10. Chipola. Lassiter Landing on Choctawhatchee River, SE¼ SE¼ Sec. 13, T. 2 N., R. 17 W., Washington County, Florida.
11. Chipola. Tenmile Creek, Calhoun County, 4 miles south of Willis, Florida. Collected by Carroll Cook.
12. Type Chipola. Tenmile Creek, from bridge to one-half mile below bridge on the Marianna-Clarksville road, 22 miles south of Marianna, Calhoun County, Florida.
13. Type Oak Grove. At old saw-mill near Oak Grove on right bank of Yellow River, about 100 yards below bridge on Laurel Hill-Oak Grove road, Okaloosa County, Florida.
14. Oak Grove. Senterfiet's or Tanner's Mill (abandoned), 4 miles southwest of Laurel Hill, Okaloosa County, Florida.
15. Shoal River. Small gully, 50 feet south of road and 150 feet east of bridge over White's

Creek on Eucheenna-Knox Hill road, one mile west of Valley Church, Walton County, Florida.

16. Shoal River. Small branch ¼ mile southeast of residence of J. T. G. McClellan, about ⅜ mile west of shell bluff on Shoal River which is the type locality. Collected by Karl E. Young.
17. Type *Yoldia* zone. Frazier's farm, formerly Spencer farm, SE¼ of Sec. 18, T. 2 N., R. 19 W., Walton County, Florida.
18. *Arca* zone. Road-cut east bank of Alagua Creek on Perimenter's farm, Sec. 17, T. 1 N., R. 19 W., Walton County, Florida.
19. *Arca* zone. W. E. Collin's farm, SE¼ NE¼ Sec. 15, T. 2 N., R. 15 W., Washington County, Florida.
20. *Arca* zone. SW¼ NE¼ SW¼ Sec. 16, T. 2 N., R. 15 W., Washington County, Florida.
21. *Arca* zone. NW¼ SE¼ Sec. 16, T. 2 N., R. 15 W., Spring Head, 100 yards east of road, Washington County, Florida.
22. *Arca* zone. SW¼ NW¼ Sec. 15, T. 2 N., R. 15 W., Washington County, Florida.
23. *Arca* zone. SE¼ SW¼ NE¼ Sec. 15, T. 2 N., R. 15 W., Washington County, Florida.
24. *Arca* zone. NW¼ SW¼ Sec. 15, T. 2 N., R. 15 W., Washington County, Florida.
25. *Arca* zone. NE¼ SE¼ Sec. 16, T. 2 N., R. 15 W., Washington County, Florida.
26. *Arca* zone. Flournoy's old mill, NE¼ NE¼ Sec. 34 T. 3 N., R. 18 W., Washington County, Florida.
27. Choctawhatchee. Pit of West Florida Power Company, just east of road at power dam, about 300 feet east of the hydro-electric power plant near Ward, Florida. Collected by Karl E. Young.
28. *Ecphora* zone? 300 feet above Walsingham Bridge over Econfina Creek, NE¼ Sec. 15, T. 1 N., R. 13 W., Washington County, Florida.
29. *Ecphora* zone. ½ mile above Walsingham Bridge, SW¼ Sec. 11, T. 1 N., R. 13 W., Washington County, Florida.
30. *Ecphora* zone. ½ mile above Walsingham Bridge, SE¼ Sec. 10, T. 1 N., R. 13 W., Washington County, Florida.
31. *Ecphora* zone? 220 yards above Walsingham Bridge, Econfina Creek, NE¼ Sec. 15, T. 1 N., R. 13 W., Washington County, Florida.
32. *Ecphora* zone. Jackson Bluff, near top of section, Ocklocknee River, Leon County, Florida.
33. *Ecphora* zone. Jackson Bluff, top shell bed, Ocklocknee River, Leon County, Florida.
34. *Ecphora* zone. *Pecten* bed, Jackson Bluff, Ocklocknee River, Leon County, Florida.
35. *Ecphora* zone. Jackson Bluff, Leon County, Florida.
36. *Cancellaria* zone. Gully pond, southeast of Greenhead, Washington County, Florida, on Sales-Davis Lumber Company property in the center of NW¼ NE¼ Sec. 14, T. 1 N., R. 14 W., at an approximate elevation of 59 feet.
37. *Cancellaria* zone. 1 mile above Walsingham Bridge over Econfina Creek, NW¼ SW¼ Sec. 11, T. 1 N., R. 13 W., Washington County, Florida.
38. *Cancellaria* zone. ¼ mile below Gainer's Bridge, Econfina Creek, SW¼ SE¼ Sec. 33, T. 1. N., R. 13 W., Washington County, Florida.
39. *Cancellaria* zone. Borrow pit just east of the power dam at Jackson Bluff on Ocklocknee River, Leon County, Florida.
40. *Cancellaria* zone. NE¼ Sec. 16, T. 1 S., R. 13 W., on Moccasin Creek beneath bridge, Bay County, Florida.
41. Recent. Shore sand, Swange, Dorset County, South England.

SYSTEMATIC PALEONTOLOGY

Order OSTRACODA Latreille
Suborder PODOCOPA Sars
Family CYTHERIDAE Baird
Subfamily CYTHERIDEISINAE Puri, new subfamily

Type genus—Cytherideis Jones, 1857.

Shell elongate, calcareous; surface smooth, pitted or punctate. Hinge essentially toothless, but the two valves articulate by means of noncrenulate grooves and flanges. Marginal area of variable width and radial pore canals of variable number and length; the line of concrescence usually parallels the inner margin except on the anterior. Muscle-scars a vertical row of four scars with additional scars varying from one to to six.

The subfamily includes the following genera:

Cytherideis Jones, 1857, p. 46. Genotype (present designation): *Cythere botellina* Jones, 1870, p. 157.

Copytus Skogsberg, 1939, pp. 416, 417, Genotype (by monotypy): *C. caligula* Skogsberg, 1939, pp. 418–425, text-figs. 1–13.

Pontocythere Dubovsky, 1939, pp. 25–29. Genotype (by monotypy): *P. tchernijawskii* Dubovsky, 1939, pp. 29, 53–54, figs. 38–51.

Krithe Brady, Crosskey and Robertson, 1874, pp. 183, 184, (new name). Genotype (by original designation): *Ilyobates praetexta* Sars, 1865 (1866) = *Cytherideis bartonensis* Jones, 1857, p. 50, pl. 5, figs. 2 a,b; 3 a,b.

Cushmanidea Blake, 1933, pp. 232-233. Genotype (by original designation): *C. seminuda* Cushman, 1906, p. 374, pl. 33, figs. 62–64; pl. 34, figs. 76–77.

Sahnia Puri, n. gen. Genotype: *Cytheri-*

deis subulata Brady, 1868, p. 454, pl. 35, figs. 43–46.

Neocytherideis Puri, n. gen. Genotype: *N. elongatus* Puri, n. sp.

Genus CYTHERIDEIS Jones

Cytherideis JONES 1857, p. 46 (as a subgenus of *Cythere*) pars; BRADY, 1866, p. 366 pars; BRADY, 1868 (Int. Obs.), p. 125; BRADY, 1868 (monograph), p. 454; BRADY and ROBERTSON, 1872, p. 58, 59; REUSS, 1874, p. 149; BRADY, 1878, p. 405; BRADY, 1880 ("Challenger" Report), p. 146; BRADY and NORMAN, 1889, p. 226; MÜLLER, 1894, p. 380; LIENENKLAUS, 1900, p. 535; CUSHMAN, 1906, p. 381; MÜLLER, 1912, p. 367; NEVIANI, 1928, p. 108; VAN VEEN, 1936, p. 37; EDWARDS, 1944, p. 514; VAN DEN BOLD, 1946, p. 27.
Hemicytherideis RUGGIERI, 1952, p. 60.

Genotype—*Cytherideis botellina* (Jones).

Elongate, cylindrical or tapering, approximately three to one; both ends rounded, anterior more so; left valve larger than the right and overlapping it dorsally and ventrally; surface smooth, perforate, tuberculate or papillate, marginal area broadest at the anterior where the line of concrescence does not coincide; radial pore canals few to moderately numerous, sometimes bifurcating. Muscle-scar pattern consists of a vertical row of four behind an additional three scars arranged in an arcuate manner. Hinge with a flange in the left valve which forms a furrow into which the dorsal margin of the right valve articulates. The furrow opens usually towards the anterior.

Range—Jurassic to Recent.

The genus *Cytherideis* is of great stratigraphic significance in the Tertiary rocks of the Atlantic and Gulf Coastal Plain. Of the twenty valid species of this genus in the Cenozoic of North America, eighteen commonly occur in the Gulf Coast Tertiaries. The genus first appears in the Tertiary formations of the Gulf Coast in the Wilcox where it is represented by *C. mayeri* (Howe and Garrett) and *C. mcguirti* (Howe and Garrett). Only one species, *C. viescana* Stephenson, is known to occur in the Claiborne. Three species, *C. alata* Blake, *C. perforata* Blake, and *C. gosportensis* Blake, characterize the Gosport Eocene. Three species, *C. rosefieldensis* Howe and Law, *C. byramensis* Howe and Law, and *C. vicksburgensis* Howe and Law, are restricted to the Vicksburg Oligocene. The maximum development of the genus *Cytherideis*, however, was in the Miocene where it is represented by nine species. *C. rugosus* Stephenson is known to occur only in the strata generally referred to as the *Discorbis-Heterostegina-Marginulina* zones of lower Miocene age. *C. ulrichi* Howe and Johnson and *C. anderseni* Puri, n. sp., are restricted to lower and middle Miocene and *C. subaequalis* Ulrich and Bassler to middle Miocene. *C. agricola* Howe and Hadley, *C. fabula* Howe and Dohm, *C. ashermani* Ulrich and Bassler, and *C. wilberti* Puri, n. sp., are long-ranging species and occur throughout the Miocene. *C. rugipustulosa* Edwards is restricted to the upper Miocene (Duplin) of North Carolina.

EXPLANATION OF TEXT-FIGS. 1–14

All figs. ×45. Type numbers refer to Henry V. Howe collection, Louisiana State University, Baton Rouge, La.

FIGS. *1, 2*—*Cytherideis ashermani* Ulrich and Bassler. *1*, plesiotype no. 2464, a left valve from locality no. 14; *2*, plesiotype no. 2447, a right valve from locality no. 13. (p. 910)

3, 4—*Cytherideis fabula* Howe and Dohm. *3*, plesiotype no. 2455, a right valve from locality no. 19; *4*, plesiotype no. 2454, a left valve from locality no. 19. (p. 911)

5, 6—*Cytherideis ulrichi* Howe and Johnson. *5*, plesiotype no. 2459, a left valve from locality no. 13; *6*, plesiotype no. 2456, a left valve from locality no. 19. (p. 911)

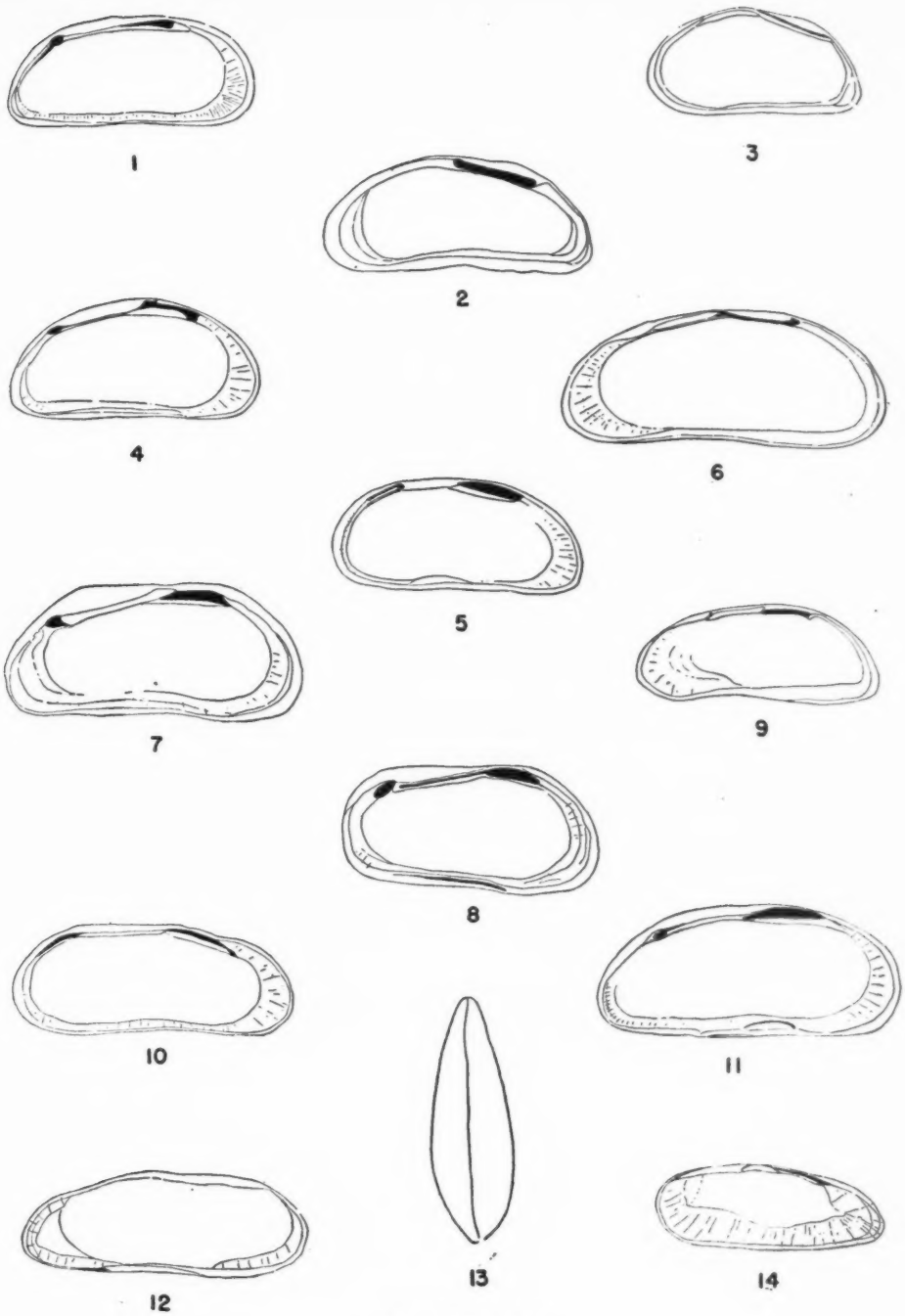
7, 8—*Cytherideis wilberti* Puri, n. sp. *7*, cotype no. 2444, a left valve from locality no. 10; *8*, cotype no. 2443, a left valve from locality no. 10. (p. 908)

9, 10—*Cytherideis anderseni* Puri, n. sp. *9*, cotype no. 2440, a right valve from locality no. 10; *10*, cotype no. 2442, a left valve from locality no. 10. (p. 908)

11—*Cytherideis agricola* Howe and Hadley, plesiotype no. 2452, a left valve from locality no. 15. (p. 910)

12—*Neocytherideis elongatus* Puri, n. sp., paratype no. 2463, a right valve from locality no. 41. (p. 913)

13, 14—*Sahnia subulata* (Brady). *13*, neotype no. 2460, dorsal view of a complete specimen from locality no. 41; *14*, hypotype no. 2461, a left valve from locality no. 41. (p. 912)



TEXT-FIGS. 1–14

CYTHERIDEIS ANDERSENI Puri, n. sp.
Plate 130, figs. 15–17; text-figs. 9, 10

Carapace elongate, inflated towards the posterior end. Dorsal margin gently arched, ventral margin nearly straight, slightly concave in front of the middle. Anterior end bluntly rounded, posterior obliquely rounded, sometimes rather drawn out. Surface of the carapace smooth but marked with scattered white spots where the normal pore canals approach the surface. Viewed from inside, the carapace is moderately deep, flanked by a well-defined marginal area which is broadest around the anterior end. Radial pore canals moderately numerous, occurring in bunches of two or three around the anterior end. The marginal area of the right valve bears a low, sharp flange except for short distance along the hinge-line, where the dorsal margin is grooved. Anterior half of the hinge-line of the right valve marked by a groove which gradually opens into the inner cavity anteriorly; posterior end marked by a similar groove; between the anterior and the posterior groove there is a narrow raised bar.

Dimensions of cotype no. 2439. a right valve from locality no. 11: length, .574 mm.; height, .202 mm.; cotype no. 2440, a right valve from locality no. 10: length, .794 mm.; height, .371 mm.; cotype no. 2441, a left valve from locality no. 19: length, .608 mm.; height, .219 mm.; cotype no. 2442, a left valve from locality no. 10: length, .946 mm.; height, .371 mm. The figured specimens came from Chipola localities nos. 1 and 10 and *Arca*-zone locality no. 19. This species also occurs at Chipola localities nos. 3, 6, 7, 9, 11 and *Arca*-zone localities nos. 20, 23, and 25.

This species is distinctive in its smooth, elongated carapace. There is no other species known in the Miocene that bears any resemblance to it.

CYTHERIDEIS WILBERTI Puri, n. sp.
Plate 130, figs. 9, 10; text-figs. 7, 8

Carapace elongate, somewhat inflated towards the posterior end. Dorsal margin gently arched, ventral margin nearly straight, slightly concave in front of the middle. Anterior and posterior ends blunt and obliquely rounded. Carapace nearly uniform in height; greatest height just in front of the center. Surface of the carapace ornamented by rounded tubercles or bumps. Viewed from inside, the valves are moderately deep, flanked by a well-marked marginal area which is broadest around the anterior end. Line of concrescence nearly coincides with the inner margin. Radial pore canals fairly common, somewhat widely spaced, fewer in number along the ventral and posterior margins, and generally not conspicuous because of the thick nature of the carapace. The marginal area bears a raised rim around the anterior, ventral, and posterior portions. This rim parallels the ventral margin near the outside but on the posterior it cuts straight and obliquely

---

EXPLANATION OF PLATE 130

All figures ×45. Type numbers refer to Henry V. Howe collection, Louisiana State University, Baton Rouge, La.

FIGS. *1–3*—*Cytherideis agricola* Howe and Hadley. *1*, plesiotype no. 2450, a left valve from locality no. 19; *2*, plesiotype no. 2451, a right valve from locality no. 19; *3*, plesiotype no. 2453, a right valve from locality no. 15. (p. 910)

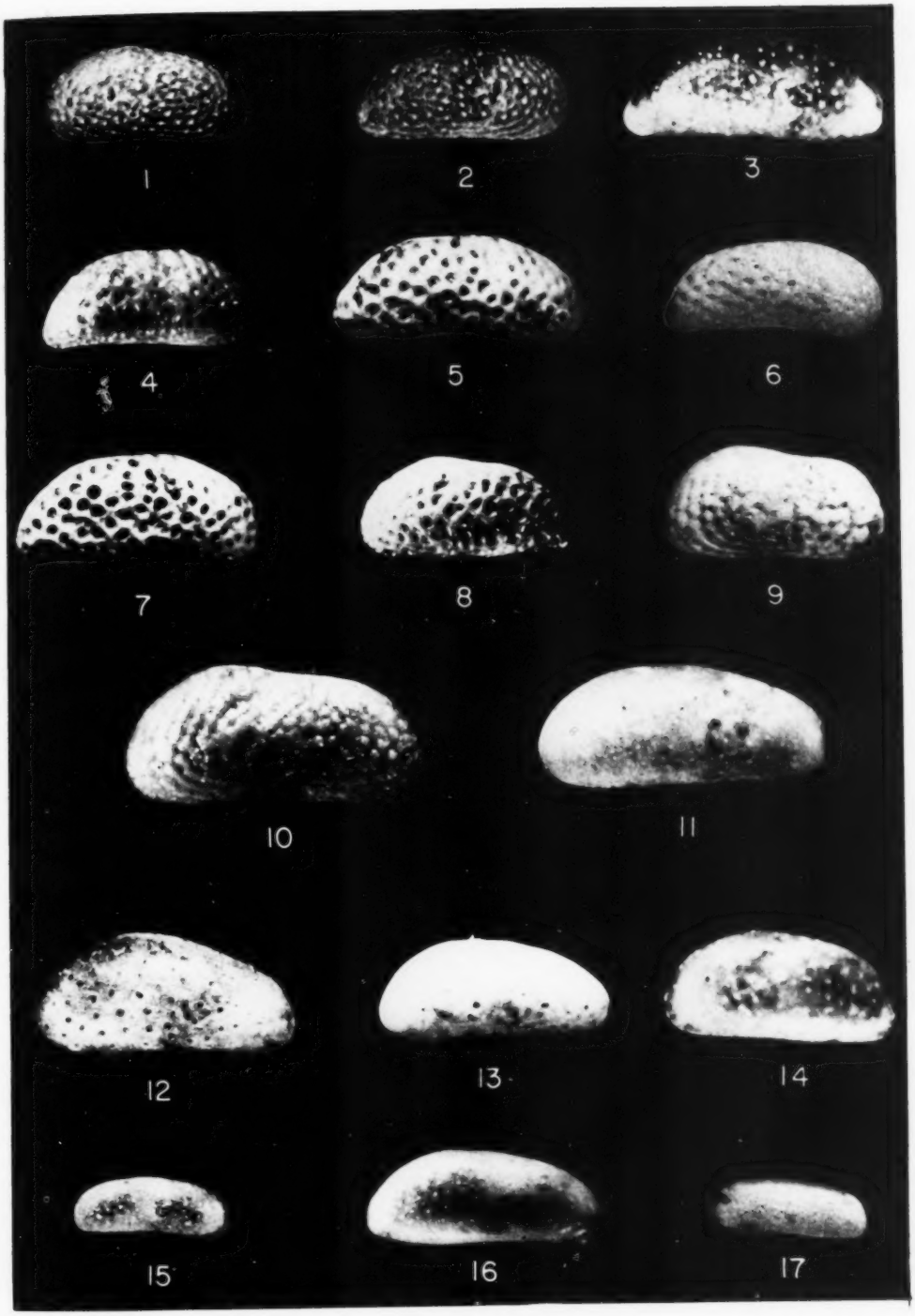
4–8—*Cytherideis ashermani* Ulrich and Bassler. *4*, plesiotype no. 2445, a right valve from locality no. 10; *5*, plesiotype no. 2446, a right valve from locality no. 13; *6*, plesiotype no. 2448, a right valve from locality no. 33; *7*, plesiotype no. 2447, a right valve from locality no. 13; *8*, plesiotype no. 2449, a right valve from locality no. 10. (p. 910)

9, 10—*Cytherideis wilberti* Puri, n. sp. *9*, cotype no. 2443, a left valve from locality no. 10; *10*, cotype no. 2444, a left valve from locality no. 10. (p. 908)

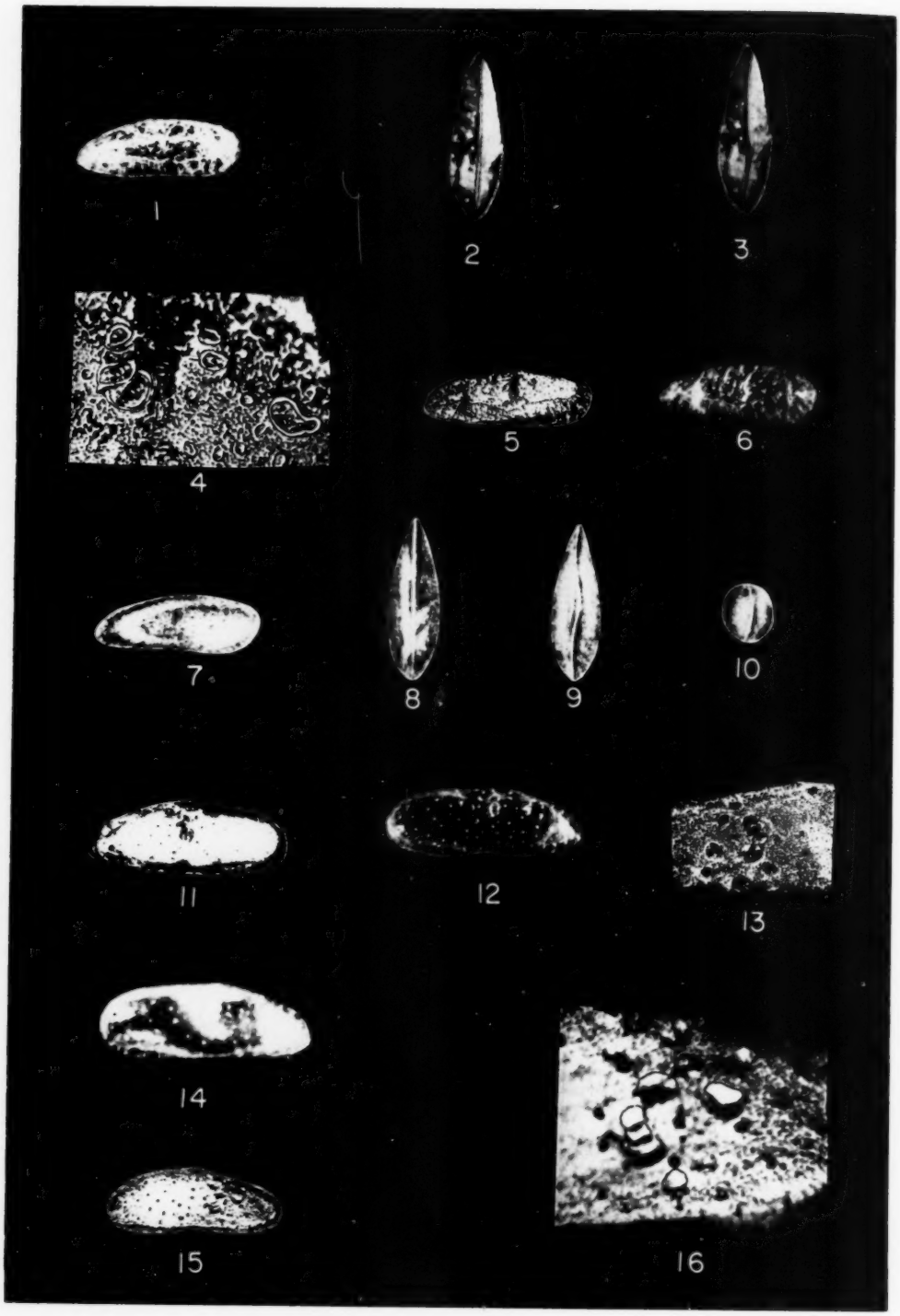
11–13—*Cytherideis ulrichi* Howe and Johnson. *11*, plesiotype no. 2456, a left valve from locality no. 19; *12*, plesiotype no. 2457, a left valve from locality no. 14; *13*, plesiotype no. 2458, a left valve from locality no. 13. (p. 911)

14—*Cytherideis fabula* Howe and Dohm, plesiotype no. 2454, a left valve from locality no. 19. (p. 911)

15–17—*Cytherideis anderseni* Puri, n. sp. *15*, cotype no. 2439, a right valve from locality no. 11; *16*, cotype no 2440, a right valve from locality no. 10; *17*, cotype no. 2441, a left valve from locality no. 19. (p. 908)

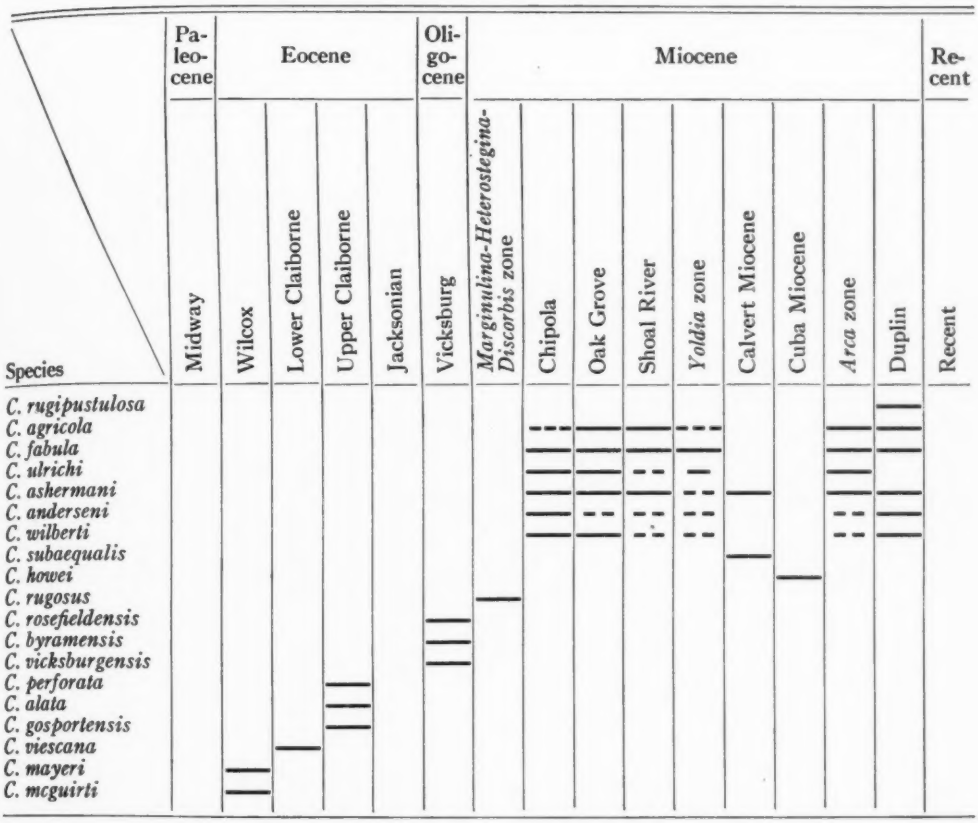


Puri, Cytherideis and its Allies



Puri, Cytherideis and its Allies

CHART I.—RANGE OF GENUS *Cytherideis* IN THE CENOZOIC OF AMERICA



through the ends, approaching the inner margin. Anterior half of the hinge-line of the right valve marked by a groove which opens into the inner cavity anteriorly; posterior end marked by a depressed socket; between the groove and the socket there is a narrow raised bar.

Dimensions of cotype no. 2443, a right valve from locality no. 10: length, .828 mm.; height, .422 mm.; cotype no. 2444, a right valve from locality no. 10: length, .997 mm.; height, .456 mm.

The figured specimens came from Chipola locality no. 10. This species also occurs at

EXPLANATION OF PLATE 131

All figures, unless otherwise indicated, ×45. Type numbers refer to Henry V. Howe collection, Louisiana State University, Baton Rouge, La.

FIGS. *1–6*—*Sahnia subulata* (Brady). *1*, neotype no. 2460, left valve view of a complete specimen from locality no. 41; *2*, dorsal view of the same specimen; *3*, ventral view of the same specimen; *4*, hypotype no. 2462, a left valve from locality no. 41 showing muscle-scar pattern; *5*, same specimen as seen in glycerine; *6*, hypotype no. 2461, a left valve from locality no. 41. (p. 912)

7–10—*Sahnia subulata* (Brady). Reproductions of Brady's original figures 43–46, plate 35. (p. 912)

11–14—*Neocytherideis elongatus* Puri, n. sp. *11*, holotype no. 2465, interior view of a right valve from locality no. 41; *12*, exterior view of the same specimen; *13*, same specimen showing muscle-scar pattern; *14*, paratype no. 2463, a right valve from locality no. 41. (p. 913)

15, 16—*Cytherideis* sp. *15*, slide no. 2466, interior view of a left valve from locality no. 41; *16*, same specimen showing muscle-scar pattern.

Chipola localities nos. 3, 8, 9, Oak Grove locality no. 12 and *Cancellaria*-zone localities nos. 36 and 38.

The characteristic bumpy ornamentation of the carapace of this species makes it quite distinct. There is no known species in the Tertiary of the Gulf Coast that could be confused with it.

CYTHERIDEIS ASHERMANI Ulrich and Bassler

Plate 130, figs. 4–8; text-figs. 1, 2

Cytherideis ashermani ULRICH and BASSLER, 1904, Md. Geol. Surv., Miocene Rept., p. 126, pl. 37, figs. 10–16.

Cytherideis longula ULRICH and BASSLER, 1904, Md. Geol. Surv., Miocene Rept., p. 128, pl. 37, figs. 21–27.

Cytherideis semicircularis ULRICH and BASSLER, 1904, Md. Geol. Surv., Miocene Rept., p. 127, pl. 37, figs. 18–20.

Cytherideis ashermani Ulrich and Bassler, HOWE ET AL., 1935, Fla. Geol. Surv. Bull. 13, p. 14, pl. 3, figs. 8–10.

Carapace elongate, subcylindrical, broadest just posterior to the middle. Dorsal margin arcuate, ventral margin almost straight, slightly sinuate in right valve. Both anterior and posterior ends rounded, posterior more acute than the anterior, more so in the right valve. Surface of the carapace strongly pitted and slightly reticulate. Viewed from inside the valves are moderately deep. Marginal area narrow, broadest around the anterior end. In the right valve, there is a well-marked marginal flange round the anterior, ventral, and posterior margins extending to a point anterior to the dorsal margin. This flange fits in the lipline of the left valve. The hinge of the right valve has a groove which starts just anterior to the middle and extends to the posterior cardinal angle, being terminated at both ends by the projections of the marginal flange. The hinge in the left valve consists of an elongate groove which starts just anterior to the middle and opens to the anterior, a small socket at the posterior cardinal end, and between the anterior groove and the posterior socket a flattened bar which fits in the groove of the right valve. Normal pore canals few, more common around the anterior end than the ventral and posterior margins, and rather inconspicuous because of the thick nature of the shell.

Dimensions of plesiotype no. 2445, a right valve from locality no. 10: length, .794 mm.; height, .388 mm.; plesiotype no. 2446, a right valve from locality no. 13: length, .895 mm.; height, .388 mm.; plesiotype no. 2447, a right valve from locality no. 13: length, .895 mm.; height, .371 mm.; plesiotype no. 2464, a left valve from locality no. 14: length, .861 mm.; height, .354 mm.; plesiotype no. 2448, a right valve from locality no. 33: length, .828 mm.; height, .338 mm.; plesiotype no. 2449, a right valve from locality no. 10: length, .760 mm.; height, .371 mm.

The figured specimens came from Chipola locality no. 10, Oak Grove localities nos. 13 and 14, and *Ecphora*-zone locality no. 33. This species also occurs at Chipola localities nos. 1, 2, 3, 4, 6, 7, 11, 12; Shoal River localities nos. 15, 16; *Arca*-zone localities nos. 18, 19, 20, 21, 22, 24, 25, 26; Choctawhatchee locality no. 27; *Ecphora*-zone localities nos. 28, 29, 30, 31, 32; and *Cancellaria*-zone localities nos. 37 and 39.

CYTHERIDEIS AGRICOLA Howe and Hadley

Plate 130, figs. 1–3; text-fig. 11

Cytherideis agricola HOWE and HADLEY, *in* Howe et al., 1935, Fla. Geol. Surv., Bull. 13, p. 13, pl. 3, figs. 27–30; pl. 4, fig. 8.

Carapace elongate, inflated, dorsal margin arched, ventral margin nearly straight, slightly concave in the middle; both anterior and posterior ends blunt and obliquely rounded, posterior end more so. Carapace of nearly uniform height; greatest height slightly anterior to the center. Surface of the carapace displaying pits arranged nearly parallel to the margin with a tendency to develop slight ridges on the anterior half. Marginal area narrow, widest at the anterior and posterior ends with a raised rim around the anterior, ventral, and posterior portions parallel to the ventral margin, but on the posterior straight and oblique across the end approaching the inner margin; at the anterior end, however, it comes nearer the inner margin than the outer. Line of concrescence nearly coincides with inner margin except at the anterior where the inner lamella widens and slopes strongly away from the median plane. Pore canals fairly numerous, straight, widely spaced, and more numerous

on the anterior than on the posterior and ventral sides. Hinge in the right valve consists of a long, deep groove at the anterior, a small, deep socket at the posterior, and a narrow, raised bar between the anterior groove and the posterior socket, separated from the dorsal margin by a narrow, incised line.

Dimensions of plesiotype no. 2450, a left valve from locality no. 19: length, .760 mm.; height, .371 mm.; plesiotype no. 2451, a right valve from locality no. 19: length, .794 mm.; height, .422 mm.; plesiotype no. 2452, a left valve from locality no. 15: length, 1.014 mm.; height, .422 mm.; plesiotype no. 2453, a right valve from locality no. 15: length, .963 mm.; height, .405 mm.

The figured specimens came from *Arca*-zone locality no. 19 and Shoal River locality no. 15. This species also occurs at Oak Grove localities nos. 13, 14; Choctawhatchee locality no. 27; *Arca*-zone localities nos. 20, 21, 22, 23, 25; *Ecphora*-zone localities nos. 28, 29, 30, 31; and *Cancellaria*-zone localities nos. 39 and 40. It also occurs questionably at Chipola locality no. 5.

CYTHERIDEIS ULRICHI Howe and Johnson

Plate 130, figs. 11–13; text-figs. 5, 6

Cytherideis ulrichi HOWE and JOHNSON, in Howe et al., 1935, Fla. Geol. Surv., Bull. 13, p. 16, pl. 3, figs. 11–14.

Carapace elongate, inflated. Dorsal margin slightly arched, ventral margin nearly straight, slightly concave just in front of the middle. Both anterior and posterior ends obliquely rounded. Surface of the carapace smooth but with numerous white spots where the normal pore canals approach the surface. Viewed from inside, the valves are moderately deep with a well-defined marginal area which is broader at the anterior end. Line of concrescence nearly coincides with the inner margin but leaves the inner margin at the anterior end and approaches the outer. Radial pore canals fairly common around the anterior, occurring in bunches of two or three, but less common along the ventral and posterior margins. The marginal area in the right valve bears a sharp, narrow flange except at the dorsal margin where the hinge is grooved. This groove starts at the middle and extends about one-third the distance toward the posterior end. The marginal area of the left valve bears a lip-line near the outside. The hinge in the left valve consists of an infolding of the dorsal margin from the center extending to about one-third the distance toward the posterior end. There is a long, narrow socket at the posterior end.

Dimensions of plesiotype no. 2456, a left valve from locality no. 19: length, 1.081 mm.; height, .456 mm.; plesiotype no. 2457, a left valve from locality no. 14: length, .963 mm.; height, .456 mm.; plesiotype no. 2458, a left valve from locality no. 13: length, .845 mm.; height, .354 mm.; plesiotype no. 2459, a left valve from locality no. 13: length, .845 mm.; height, .354 mm.

The figured specimens came from *Arca*-zone locality no. 19 and Oak Grove localities nos. 13 and 14. The species also occurs at Chipola localities nos. 5 and 12, and *Arca*-zone localities nos. 20, 21, 22, 23, and 25.

CYTHERIDEIS FABULA Howe and Dohm

Plate 130, fig. 14; text-figs. 3, 4

Cytherideis fabula HOWE and DOHM, *in* Howe et al., 1935, Fla. Geol. Surv., Bull. 13, p. 15, pl. 3, figs. 15, 16, 20, 23; pl. 4, fig. 2.

Carapace elongate, convex, dorsal outline subsemicircular, ventral slightly concave. Both anterior and posterior ends obliquely rounded. Anterior end much broader than posterior. Greatest thickness of carapace just behind and a little below the middle; greatest length near the ventral margin. Surface of carapace smooth. Viewed from inside, the valves are moderately deep. The marginal areas are broad around the anterior and fairly broad at the acute posterior extremity. The line of concrescence lies near the outer margin. The radial pore canals are straight, somewhat irregularly spaced, and of fairly common occurrence at the anterior, ventral, and posterior ends. The hinge is simple and in the left valve consists of a deep, slightly arcuate anterior groove; a posterior short, narrow groove below the dorsal margin; between the anterior groove and the posterior groove, there is an elongate, projecting bar which is not separated from the dorsal margin. The posterior half of the dorsal margin in the right

valve consists of a narrow groove into which the bar of the left fits.

Dimensions of plesiotype no. 2454, a left valve from locality no. 19: length, 1.030 mm.; height, .490 mm.; plesiotype no. 2455, a right valve from locality no. 19: length, .845 mm.; height, .405 mm.

All the figured specimens came from *Arca*-zone locality no. 19. This species also occurs at Chipola localities nos. 4, 6, 7, 10, 12; Oak Grove locality no. 13; Shoal River localities nos. 15, 16; *Yoldia*-zone locality no. 17; *Arca*-zone localities nos. 20, 21, 22, 23, 25, 26; *Ecphora*-zone localities nos. 33, 34, 35; and *Cancellaria*-zone localities nos. 37, 39.

Genus SAHNIA Puri, n. gen.

Cytherideis Brady, 1868 (monograph), p. 454.

Genotype—Sahnia subulata (Brady).

Carapace elongate, cylindrical; length approximately three times height. Both ends rounded. Surface punctate. Marginal areas very broad, covering more than one-third of the carapace. Radial pore canals numerous, long, wavy, sometimes bifurcating. Muscle-scar pattern consists of four scars arranged vertically in an arcuate fashion, with a drop-shaped scar behind and two small scars lying vertically in between. Hinge similar to *Cytherideis*.

This genus is easily distinguished from the rest of the members of Cytherideisinae by its broad marginal areas and the punctate nature of its carapace.

SAHNIA SUBULATA (Brady)

Plate 131, figs. 1–10; text-figs. 13, 14

Cythere flavida BAIRD, 1850, (not *Cythere flavida* Müller 1785; not *Cythere* (*Cytherideis*) *flavida* Müller of Jones 1857), Roy. Soc. London, p. 21, figs. 12, 12a.

Cytherideis subulata BRADY, 1868, Linnean Soc. London, Trans., vol. 26, p. 454, pl. 35, figs. 43–46.

Cytherideis subulata BRADY, 1868, Intellectual Observer, vol. 12, p. 125.

Cytherideis subulata BRADY, 1869, Annals and Mag. Nat. History (4), vol. 3, p. 45.

Cytherideis subulata BRADY and ROBERTSON, 1872, Annals and Mag. Nat. History (4), vol. 9, p. 58, pl. 1, figs. 12, 13; pl. 2, figs. 11–13.

Cytherideis subulata var. *fasciata* BRADY and ROBERTSON, 1874, Annals and Mag. Nat. History (4), vol. 13, p. 117, pl. 5, figs. 1–5.

Cytherideis subulata BRADY, 1875, in Les fonds de la mer, vol. 2, pt. 1, p. 11.

Cytherideis faveolata MALCOMSON, 1886, Proc. Belfast Nat. Field Club, 1884–1886 (2), vol. 2, p. 281, pl. 25, figs. 8–12.

Carapace elongate, length approximately three times height; sharply rounded and much attenuated in front, broadly and obliquely rounded behind. Dorsal margin sloping with a gentle curve from the middle toward the anterior end; ventral margin slightly sinuated in the middle. Seen from above, the carapace is compressed ovate, tapering to an acute point at both the extremities, but more acute on the anterior end. Carapace thin and fragile, yellowish in color. Surface of the carapace ornamented with closely-set, impressed punctae. Center of the valves inconspicuously sulcate in the middle. Seen from inside, the carapace is transparent and moderately shallow. Marginal areas are very broad and cover more than one-third of the total area. Radial pore canals numerous, wavy, sometimes bifurcating. Muscle-scar pattern consists of four scars arranged vertically, a drop-shaped scar situated behind with another two scars lying between. Hinge similar to *Cytherideis*.

Dimensions of neotype no. 2460, a complete specimen from locality no. 41: length, .591 mm.; height, .219 mm.; hypotype no. 2461, a left valve from locality no. 41: length, .591 mm.; height, .209 mm.; hypotype no. 2462, a left valve from locality 41: length, .591 mm.; height, .219 mm.

All figured specimens came from shore sand at Swange, Dorset County, South England, where this species occurs in moderate quantity.

No satisfactory description of the shell of *S. subulata* exists; the type specimens have been lost (Sylvester-Bradley, personal communication, February, 1952). Therefore, the species is redescribed on the basis of new specimens.

Genus NEOCYTHERIDEIS Puri, n. gen.

Genotype—Neocytherideis elongatus Puri, n. sp.

Carapace in outline similar to *Cytherideis*. Marginal areas very narrow, confined to the anterior and posterior margins. Radial pore canals few, short, widely spaced, and straight. Muscle-scar pattern consists of four reniform scars arranged vertically in an arcuate manner with an additional six

scars around the vertical row. Hinge indistinct but similar to *Cytherideis*.

NEOCYTHERIDEIS ELONGATUS Puri, n. sp.
Plate 131, figs. 11–14; text-fig. 12

Carapace elongate, much attenuated in front, highest behind; greatest height equal to one-third of the length; sharply rounded in front, broadly rounded behind. Dorsal margin straight in the posterior half, slightly oblique and gently sloping in the anterior half. Ventral margin straight. Surface of the carapace smooth and glassy with relatively few, widely-spaced normal pore canals. Seen from inside, the valves are moderately shallow and translucent. Marginal areas narrow, confined to the anterior and posterior margins. Radial pore canals few, widely spaced, and straight; more numerous in the anterior than in the posterior margin. Hinge slight. Muscle-scar pattern consists of four reniform scars vertically arranged with six additional scars around the vertical row.

Dimensions of holotype no. 2465, a right valve from locality no. 41: length, .726 mm.; height, .270 mm.; paratype no. 2463, a right valve from locality no. 41: length, .743 mm.; height, .287 mm.

All figured specimens came from shore sand, Swange, locality no. 41.

REFERENCES

BLAKE, C. H., 1933, Ostracoda: *in* Biological Survey of Mount Desert Region, Pt. 5, pp. 229–241, fig. 40.

BLAKE, DANIEL B., 1950, Gosport Eocene Ostracoda from Little Stave Creek, Alabama: Jour. Paleontology, vol. 24, pp. 174–184, pls. 29–30.

BRADY, G. S., 1866, On new or imperfectly known species of marine Ostracoda (1865): Zool. Soc. London, Trans., vol. 5, pp. 359–393, pls. 57–62.

——, 1868, A monograph of the Recent British Ostracoda: Linnaean Soc. London, Trans., vol. 26, pp. 353–495, pls. 23–41.

——, 1868, A synopsis of the Recent British Ostracoda: Intellectual Observer, vol. 12, pp. 110–120, pls. 1, 2.

——, 1878, Monograph of the Ostracoda of the Antwerp Crag: Zool. Soc. London, Trans., vol. 10, pp. 379–409, pls. 62–69.

——, 1880, Report on the scientific results of the voyage of *H.M.S. Challenger* during the years 1873–1876: Zoology, vol. 1, pt. 3, Ostracoda, 184 pp., 44 pls.

——, CROSSKEY, W. E., and ROBERTSON, D., 1874, Monograph of the post-Tertiary Entomostraca of Scotland and parts of England and Ireland: Palaeont. Soc. London Publ., pp. 1–274, pls. 1–16.

——, and NORMAN, A. M., 1889, A monograph of the marine and freshwater Ostracoda of the North Atlantic and northwestern Europe. Section 1, Podocopa: Roy. Dublin Soc. Sci. Proc. (2), vol. 4, pp. 63–270, pls. 8–23.

——, and ROBERTSON, D., 1872, On the distribution of the British Ostracoda: Annals and Mag. Nat. History (4), vol. 9, pp. 48–70, pls. 1, 2.

——, and ROBERTSON, D., 1874, On Ostracoda taken amongst the Scilly Islands, and on the anatomy of *Darwinella stevensoni:* Annals and Mag. Nat. History (4), vol. 13, pp. 114–118, pls. 4, 5.

CUSHMAN, J. A., 1906, Marine Ostracoda of Vineyard Sound and adjacent waters: Boston Soc. Nat. History, Proc., vol. 32, no. 10, pp. 359–385, pls. 27–38.

——, and PONTON, M. P., 1932, The Foraminifera of the upper, middle and part of the lower Miocene of Florida: Florida Geol. Survey, Bull. 9, 147 pp., 17 pls.

DUBOVSKY, N. F., 1939, Materials contributory to the knowledge of the ostracod fauna of the Black Sea: Trav. Station Biological Karadagh 5, pp. 3–38. (Russian with German resumé).

EDWARDS, RICHARD A., 1944, Ostracoda from the Duplin marl (upper Miocene) of North Carolina: Jour. Paleontology, vol. 18, pp. 505–528, pls. 85–88.

HOWE, H. V., and CHAMBERS, JACK, 1935, Louisiana Jackson Eocene Ostracoda: Louisiana Geol. Survey, Bull. 5, pp. 1–65, pls. 1–6.

——, and GARRETT, J. B., 1934, Louisiana Sabine Eocene Ostracoda: Louisiana Geol. Survey Bull. 4, 77 pp., 4 pls.

——, and GRADUATE STUDENTS, 1935, Ostracoda of the *Arca* zone of the Choctawhatchee Miocene of Florida: Florida Geol. Survey, Bull. 13, pp. 1–37, 4 pls.

——, and LAW, JOHN, 1936, Louisiana Vicksburg Oligocene Ostracoda: Louisiana Geol. Survey, Bull. 7, 96 pp., 6 pls.

JONES, T. RUPERT, 1856, Notes on the Entomostraca *in* E. Forbes' On the Tertiary fluvio-marine formation of the Isle of Wight: Mem. Geol. Surv. Great Britain, pp. 157–158, pl. 7.

——, 1857, A monograph of the Tertiary Entomostraca of England: Palaeont. Soc. London Publ., 68 pp., 6 pls.

——, 1870, Notes on the Cretaceous Entomostraca: Geol. Mag., dec. 1, vol. 7, pp. 74–77.

——, 1870, Notes on the Tertiary Entomostraca of England: Geol. Mag., dec. 1, vol. 7, pp. 155–159.

——, and SHERBORN, C. D., 1887, Further notes on the Tertiary Entomostraca of England with special reference to those from the London clay: Geol. Mag., dec. 3, vol. 4, pp. 385–392, pl. 9; pp. 450–460.

——, and SHERBORN, C. D., 1889, A supplementary monograph of the Tertiary Entomostraca of England: Palaeont. Soc. London Publ., pp. 1–55, 3 pls.

LIENENKLAUS, E., 1900, Die Ostrakoden des mittleren Norddeutschlands: Zeitschr. Deutsch

Geol. Gesell., 52 bd., pp. 497–550, 10 text-figs., pls. 19–22.

MÜLLER, G. W., 1894, Fauna und flora des golfes von Neapel: Mon. 21, Zool. Station of Naples, pp 1–404, 40 pls.

——, 1912, Das Tierreich, L. 31, Ostracoda: pp. 1–434, 92 pls.

NEVIANI, A., 1928, Ostracodi fossili d'Italia. I. Vallebiaja (Calabriano): Mem. Pont. Acc. Nuovi, Lincei, Mem. (2), vol. 11, pp. 1–118, 2 pls.

RUGGIERI, GIULIANO, 1952, Nota preliminare sugli Ostracodi di alcune spiaggie adriatiche: Note Lab. Biologia Marina di Fani, Ann. Inst. Zool. Univ. Bologna, vol. 1, pp. 57–64, 1 text-fig.

SKOGSBERG, T., 1939, A new genus and species of marine ostracods from south Georgia: California Acad. Sci. Proc., vol. 23, pp. 514–525, 13 figs.

STETHENSON, MORTON B., 1944, Ostracoda from the Reklaw Eocene of Bastrop County, Texas: Jour. Paleontology, vol. 18, pp. 448–454, pl. 76.

——, 1944, Reklaw Ostracoda, a correction: Jour. Paleontology, vol. 18, p. 560.

——, 1946, Weches Eocene Ostracoda from Smithville, Texas: Jour. Paleontology, vol. 20, pp. 297–344, pls. 42–45.

——, 1947, Weches Ostracoda, corrections: Jour. Paleontology, vol. 21, pp. 579–581.

SYLVESTER-BRADLEY, P. C., 1946, Some ostracod genotypes: Annals and Mag. Nat. History (11), vol. 13, (1947), pp. 192–199.

ULRICH, E. O., and BASSLER, R. S., 1904, Systematic paleontology of the Miocene deposits of Maryland: Maryland Geol. Survey, Miocene Report, Ostracoda, pp. 98–130, pls. 35–38.

VAN DEN BOLD, WILLEM A., 1946, Contribution to the study of Ostracoda with special reference to the Tertiary microfauna of the Caribbean region: Amsterdam, pp. 1–167, 18 pls.

VAN VEEN, J. E., 1936, Die Cytheridae der Maastrichter Tuffkreide und des Kunrader Korallenkalkes von Süd-Limburg. IV. Die Gattungen *Cythereis*, *Archicythereis* und *Cytherideis:* Geol.-mijnb. genootsch. Nederland en Kolonien Verh., Geol. ser. 25e Jrg., pp. 131–168, pls. 1–9.

JOURNAL OF PALEONTOLOGY, VOL. 26, NO. 6, PP. 915–923, PL. 132, 4 TEXT FIGS., NOVEMBER 1952

PRAEAMMOASTUTA, NEW FORAMINIFERAL GENUS OF THE VENEZUELAN TERTIARY, WITH AN EMENDATION OF *AMMOASTUTA* CUSHMAN AND BRÖNNIMANN

J. G. BURSCH
Phillips Oil Company, Caracas, Venezuela

ABSTRACT—*Praeammoastuta*, a new genus (genotype: *P. alberdingi*, new species), having a minute, arenaceous test (average size 0.3 mm.), shows multiformity which is primarily due to the distinctive shape and size of the chambers at successive growth stages and not to the usually variable chamber arrangement at different phases of individual development of smaller, multiform foraminifers. The closely related *Ammoastuta* Cushman and Brönnimann, as emended, includes tests having a similar multiform, curvilinear structure, but also exhibiting a supplementary, cribrate aperture which *Praeammoastuta* lacks. The latter genus is believed to be ancestral to *Ammoastuta* for morphological and stratigraphic reasons. Both genera are questionably placed in the Reophacidae (subfamily Reophacinae).

INTRODUCTION

THE present paper describes a genus of the smaller Foraminifera which has been recently discovered in the Andean region of western Venezuela. The rock samples containing this genus were collected by Dr. Herbert Alberding in the years 1949 and 1950 when he functioned as geological field party chief for the Phillips Oil Company in the State of Táchira. The samples were taken from the León formation[1] of Oligocene age (fig. 1) from exposures on the newly constructed road leading from the city of San Cristóbal to the town of San Antonio near the boundary between Venezuela and Colombia (fig. 2).

Examination of the wash residues yielded a suite of more than a hundred specimens of this smaller foraminifer which could not be placed in any known genus or species. These are described in this report as *Praeammoastuta alberdingi*.

[1] The León formation at its type locality at the Quebrada León, Department of Santander del Norte, Colombia, has been described in detail by Notestein, Hubman, and Bowler (1944, p. 1201). Sutton (1946, p. 1677) introduced the name Lobaterita formation for an Oligocene shale body in the State of Táchira, Venezuela, which is equivalent to the León formation (Schaub, 1948, p. 221), and which can be traced across the Venezuelan-Colombian border into the latter formation (Dusenbury, 1949, p. 147). Therefore, according to the rule of priority, the term Lobaterita should be displaced in favor of the term León.

ACKNOWLEDGMENTS

The author wishes to thank Dr. P. Brönnimann, senior stratigrapher of Trinidad Leaseholds Ltd., and Dr. W. Maync, paleontologist of the Venezuelan Atlantic Refining Company, Caracas, for the loan of foraminiferal specimens. Miss Irene McCulloch was good enough to furnish information regarding a species of the genus *Ammoastuta*, specimens of which were not available to the author. Finally, acknowledgment is made to the Executive Committee of the Phillips Petroleum Company, Bartlesville, Oklahoma, who granted permission to publish this paper.

SYSTEMATIC PALEONTOLOGY

Superfamily LITUOLIDEA
Family REOPHACIDAE?
Subfamily REOPHACINAE?
Genus PRAEAMMOASTUTA Bursch, n. gen.

Genotype.— *Praeammoastuta alberdingi* Bursch, n. sp.

Diagnosis.—Test compressed, curved-uniserial, outline variable, generally subflabelliform with a lobate peripheral margin; chambers simple, close-set in curvilinear arrangement, lengthening as added, juvenile chambers small, relatively narrow, adult chambers elongate, compressed, sigmoid, tending to straighten as added, their series partly based upon the inner flank of the curved juvenarium; wall arenaceous; aper-

ture a very small opening at or near the middle of the apertural face of the last chamber.

Relationships.—The genus resembles *Ammoastuta* Cushman and Brönnimann more than any other previously described taxonomic group in having curved-uniserially arranged chambers which show similar growth stages. On the other hand, the absence of a supplementary aperture at the base of the last-formed chamber serves to distinguish *Praeammoastuta* from that genus.

The early portion of the tests of *Ammobaculites*, *Ammomarginulina*, and *Flabellammina* differs from that of *Praeammoastuta* in being close-coiled.

Because of its arenaceous test and its simple, curved-uniserially-arranged, juvenile chambers, the genus is believed to be more closely related to the Reophacidae (subfamily Reophacinae) than to any other foraminiferal family. However, the dissimilarity of most of its other structural features to those of the genera which are presently known to constitute the Reophacidae leads the writer to assign *Praeammoastuta* only tentatively to this family.

The genus falls within the scope of the superfamily Lituolidea as defined by Glaessner (1945, table 1, p. 89). Unfortunately, the description of the Lituolidea presented on a subsequent page of his textbook (p. 93), where a part of the structural characters of this superfamily is indicated to be "typically spirally coiled, at least in earlier stages of growth," does neither accord with the characters given in the above-mentioned table nor with the inclusion of the uniserial Reophacidae in the Lituolidea. This description thus appears to be inaccurate.

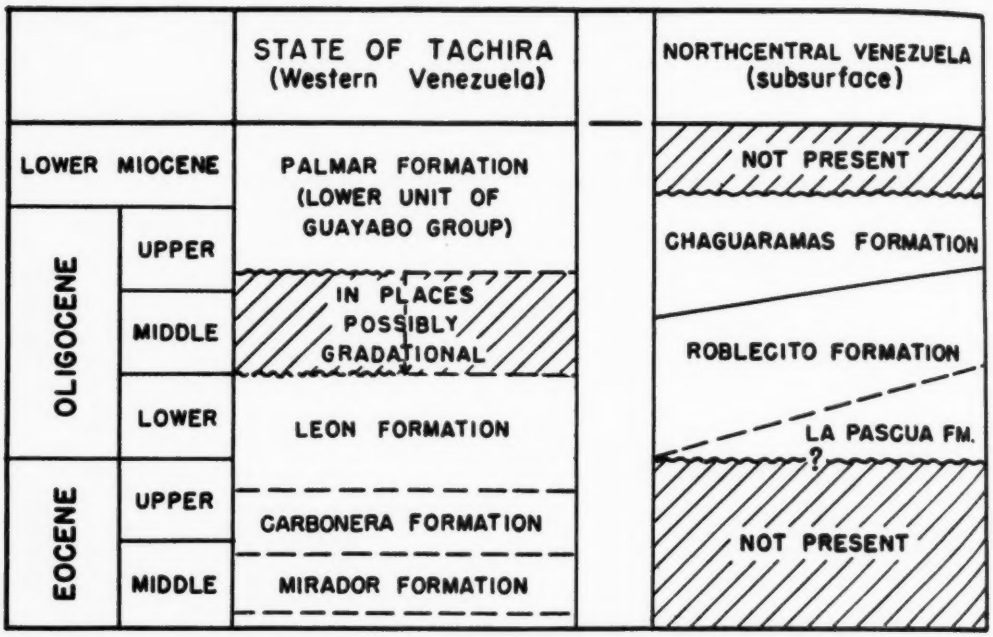


FIG. 1—Correlation chart of middle Eocene—lower Miocene formation in the State of Táchira (western Venezuela) and in north central Venezuela.

Derivation of name.—The generic name is introduced as a reflection of the apparent relationship of the genus with the younger (Recent) and structurally slightly higher developed *Ammoastuta*.

Occurrence.—To the best of the writer's knowledge the genus has been found only in Venezuela to date. It occurs very rarely to abundantly in surface samples collected from the Oligocene León formation in the State of Táchira, and it is rarely present in a cutting sample from the middle to upper Oligocene lower part of the Chaguaramas formation (fig. 1) at a depth of 5080 feet in the Venezuelan Atlantic Refining

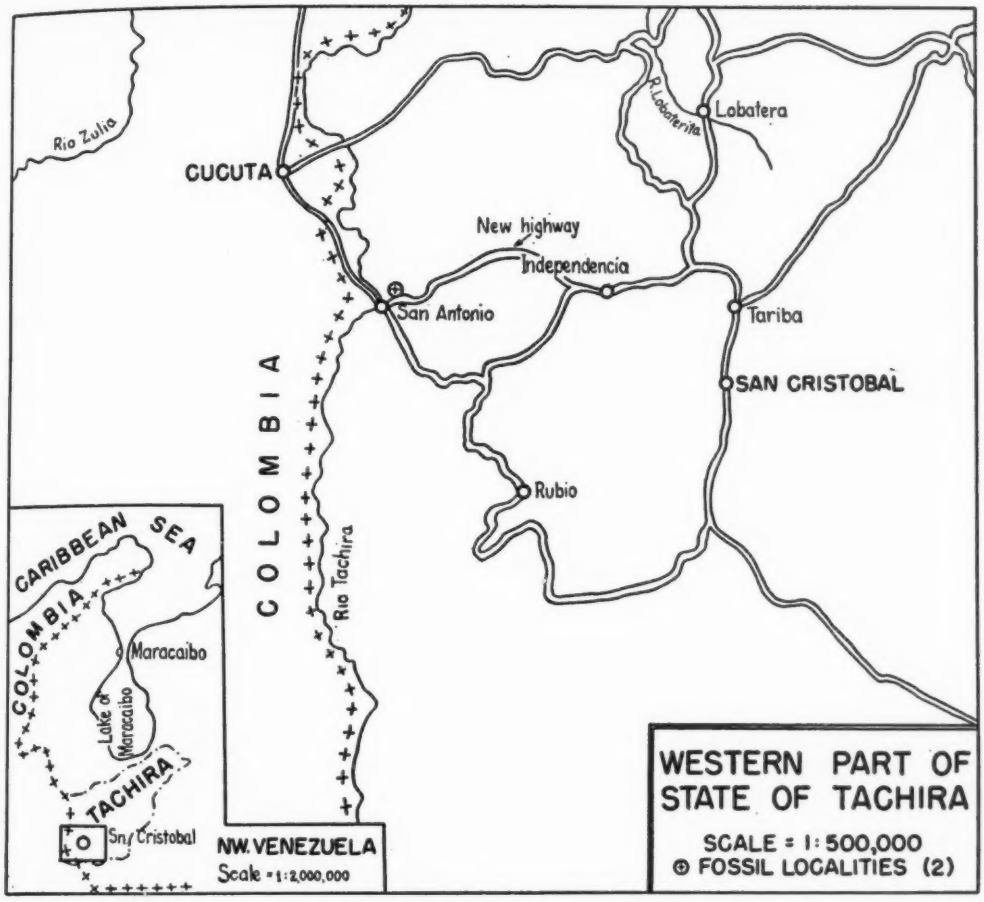


FIG. 2—Map of the western part of the State of Táchira, Venezuela, showing the fossil localities of *Praeammoastuta alberdingi*, n. gen., n. sp.

Company Tux-9 well in the State of Guárico. Specimens from this cutting first attracted the attention of Dr. W. Maync and were loaned to the writer for comparison through the courtesy of Venezuelan Atlantic Refining Company.

Associated fauna.—In both León and Chaguaramas formations the genus has been found associated only with smaller, arenaceous foraminifers which suggested a fresh- to brackish-water environment of deposition.

PRAEAMMOASTUTA ALBERDINGI Bursch, n. sp.
Plate 132, figs 1–4; text-fig. 3

Diagnosis.—Test very compressed, urved-uniserial, outline variable, generally subflabelliform with an irregularly-lobate peripheral margin; chambers simple, close-set in curvilinear arrangement, lengthening as added, juvenarium distinctive from the ephebic growth stage by the size, shape, and position of its chambers which are small, relatively narrow, slightly inflated, gradually increasing in size as added, and laterally border the base of the adult growth stage; adult chambers elongate, compressed, sigmoid, tending to straighten at later stages of individual development, their septa drawn out into a spine in typical specimens, ephebic growth stage partly based upon the inner flank of the curved juvenarium; wall translucent, consisting of a chitinous, basal layer with fine, incrusted and agglutinated, siliceous and some ferruginous mat-

ter at the surface, brownish- to grayish-white; aperture a very small opening at or near the middle of the apertural face of the last-formed chamber, often concealed by the arenaceous, superficial layer; microspheric form differs from megalospheric one by its smaller proloculus and its usually greater number of juvenile chambers.

Additional descriptive data.—The proloculus is located on the proximal prolongation of the growth axis of the juvenile chamber series (fig. 3). The thickness of its wall (5 microns) does not differ distinctively from that of the other chamber walls.

The microspheric type (sexual generation) constitutes 16% numerically of a total of 120 specimens studied. The shape of the microspheric proloculus (more or less elongate, subellipsoidal to subtriangular in side view) and its size (maximum diameter 10 microns, thickness of wall not included) are usually not unlike those of the first juvenile chamber into which the proloculus aperture opens.

The asymmetrically irregular megalospheric proloculus (asexual generation) is considerably larger than that of the B-form. Part of it may protrude and slightly flank the first juvenile chamber toward the center of the test. The megalospheric proloculus appears subdivided by one or two very thin partitions in most specimens. Whether these internal walls and the proloculus wall are broken by one or several openings (diameter 3 microns and less) could not be determined. All gradations in the shape of the megalospheric proloculus and in the direction and length of its partitions have been found.

The number of juvenile and adult chambers varies in both generations. The frequency of the number of (1) juvenile, (2) adult, and (3) total of juvenile and adult chambers of the microspheric tests are shown by the following figures:

1) Numbers of juvenile chambers	4	5	6
Numbers of specimens	5	8	6

2) Numbers of adult chambers	6	7	8	9	10	11	12
Numbers of specimens	1	0	4	5	4	4	1

3) Numbers of total of juvenile and adult chambers	12	13	14	15	16	17
Numbers of specimens	2	3	4	5	4	1

Similar counts on megalospheric tests yielded the following frequencies:

1)	1	2	3	4	5
	1	18	48	26	7

2)	6	7	8	9	10	11
	16	26	32	18	8	2

3)	8	9	10	11	12	13	14	15
	1	14	23	30	15	14	4	1

Frequency counts of approximate sizes (measured from juvenarium toward center of apertural face) of microspheric tests are reflected by the following numbers:

Approx. sizes in mm.	0.20	0.22	0.24	0.26	0.27	0.29	0.31	0.32	0.34	0.36
Numbers of specimens	1	1	0	3	2	3	3	4	0	2

The following figures reflect similar counts of megalospheric tests:

0.19	0.20	0.22	0.24	0.26	0.27	0.29	0.31	0.32	0.34	0.36	0.37
6	9	12	12	10	14	16	7	10	1	2	1

Gradually the juvenile chambers increase in size as added (fig. 3). The foramina are located near the periphery, but in some specimens they tend to shift slightly toward the center of the distal part of the one or two last, juvenile septa. Megalospheric plasmostraca show a first juvenile chamber which appears to correspond in size and shape with a later (approximately the third) juvenile chamber in microspheric tests. Also in consideration of the average number of early chambers in microspheric forms which is larger than in megalospheric ones (5 and 3, respectively), the microspheric juvenarium appears ontogenetically more complete than the corresponding growth stage in megalospheric individuals. The latter seems to have skipped the formation of two early juvenile chambers.

The first-formed adult chamber septa are usually sigmoid and approximately parallel the outline of the distal part of the last juvenile chamber and the inner flank of the curved juvenarium. Subsequent septa tend to straighten.

The foramina of the adult chambers have a distinctively larger diameter (7 to 10 microns) than those of the juvenile growth stage (3 to 5 microns). Besides, the former tend to widen in later-formed, larger chambers. The size of the foramina and that of the chambers into which they open seem proportionally interrelated.

The one or two last-formed chambers of several specimens are shorter and attain a less regular shape than the preceding chambers which suggests that they are gerontic. Because of their size and number (maximum 12 in microspheric individuals) the adult chambers make up by far the larger portion of the test. The latter is covered with an arenaceous layer which is laid down on the internal, chitinous base. The thickness of the basal layer is 5 microns.

The chamber sutures, curved to nearly straight, may appear slightly depressed, raised, or flush with the relatively rough surface of the test. Those of the juvenile chambers are usually deepened, rendering a resemblance of a curved string of beads to that growth stage. Where the chambers are not filled with pyrite, their sutures appear gray on the lighter, translucent surface of the test. The short, basal suture between the juvenarium and the base of the adult growth stage is usually slightly depressed.

Major morphologic and numerical differences between the growth stages of the test of both micro- (B-) and megalospheric (A-) forms are tabulated (table 1).

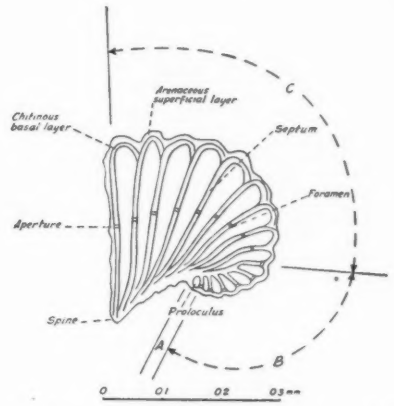


FIG. 3—General appearance of the test of *Praeammoastuta alberdingi*, n. gen., n. sp., microspheric form, as seen with transmitted light (diagrammatic). Growth stages: A, Embryonic. B, Juvenile. C, Adult.

Relationships.—The species differs from *Ammoastuta salsa* Cushman and Brönnimann and *A. inepta* (Cushman and McCulloch) in having a smaller and thinner test and in lacking a supplementary aperture at the base of the last-formed chamber.

Derivation of name.—The specific name is introduced in honor of Dr. Herbert Alberding, who collected the rock samples from the León formation which contained the specimens described in this report.

Holotype.—Length and breadth of the microspheric holotype, both 0.3 mm.; thickness, 0.06 mm. Number of juvenile chambers, 5; adult chambers, 11. The specimen is figured on Pl. 132, fig. 1.

Disposition of type specimens.— Holotype, U. S. National Museum 547643; topotypes, U. S. National Museum 547644. Other topotypes have been deposited in the type collections of the American Museum of Natural History, Department of Micropaleontology, New York; the Rijksmuseum voor Geologie, Leiden, Netherlands; the Museum of Natural History, Basel, Switzerland; and the Phillips Oil Company, Paleon-

TABLE 1.—DISTINCTIVE CHARACTERS OF THE GROWTH STAGES OF *Praeammoastuta alberdingi*, N.SP.

	Juvenarium		
	Embryonic Growth Stage	Juvenile Growth Stage	Adult (Ephebic) Growth Stage
Shape	A-form: Asymmetrically irregular; B-form: subellipsoidal to triangular in side view	Resembling curved string of beads	Compressed, subflabelliform, variable in nontypical specimens
Periph. Margin	Rounded	Rounded, slightly lobated	Sharp, irregularly lobated
Relative Size	Minute portion of test	Minor portion of test	Major portion of test
Location	Peripheral, bordering juvenile and adult growth stages	Peripheral, inner flank borders adult growth stage	Based upon embryonic and adult growth stages
Number of Chambers	A-form: Proloculus double or triple; B-form: Proloculus undivided	A-form: 3 (average) B-form: 5 (average)	A-form: 8 (average) B-form: 9 (average)
Shape of Chambers	A-form: Asymmetrically irregular; B-form: subellipsoidal to triangular in side view	Narrow, slightly inflated, triangular to subrectangular in side view	Elongate, compressed
Relative Size of Chambers	Minute	Small; first chamber usually smaller than proloculus in A-form	Large
Shape of Septa	No septa present	Distally convex to nearly straight	Sigmoid, tending to straighten as added, often drawn out into a spine
Position of Foramina	Proloculus aperture, no foramina	Near peripheral margin	In or near the middle of the septa
Diam. Foramina	3 microns and less (P. apert.)	3 to 5 microns	7 to 10 microns

tological Laboratory, Caracas, Venezuela (No. F-10501).

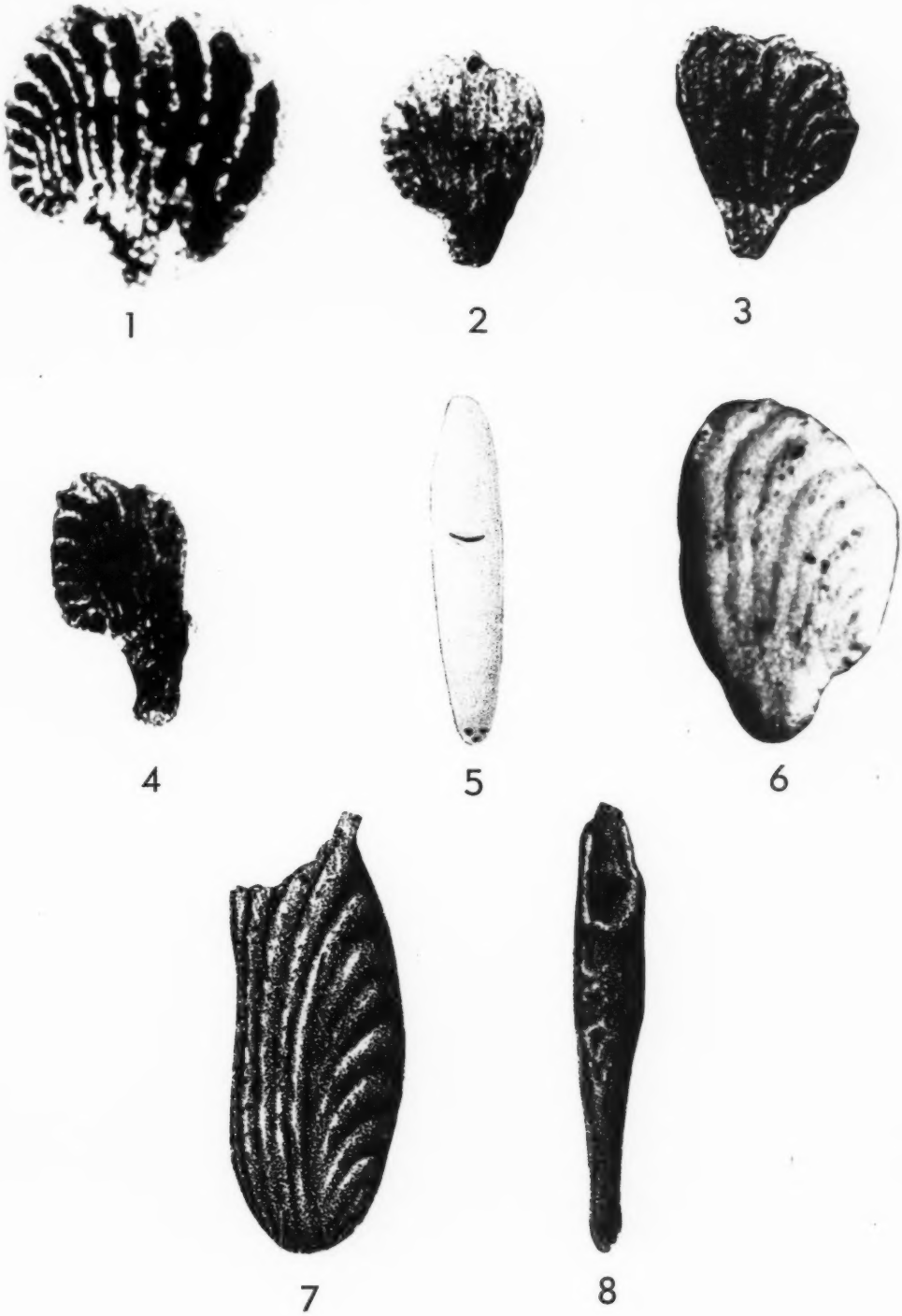
Type locality.—The holotype was collected by Dr. Herbert Alberding on August 3, 1949, at a distance of 3.9 km. from the town of San Antonio, State of Táchira, western Venezuela, from a cut on the newly constructed highway leading from the city of San Cristóbal to San Antonio, 0.5 km. southeast of the junction of this highway

EXPLANATION OF PLATE 132

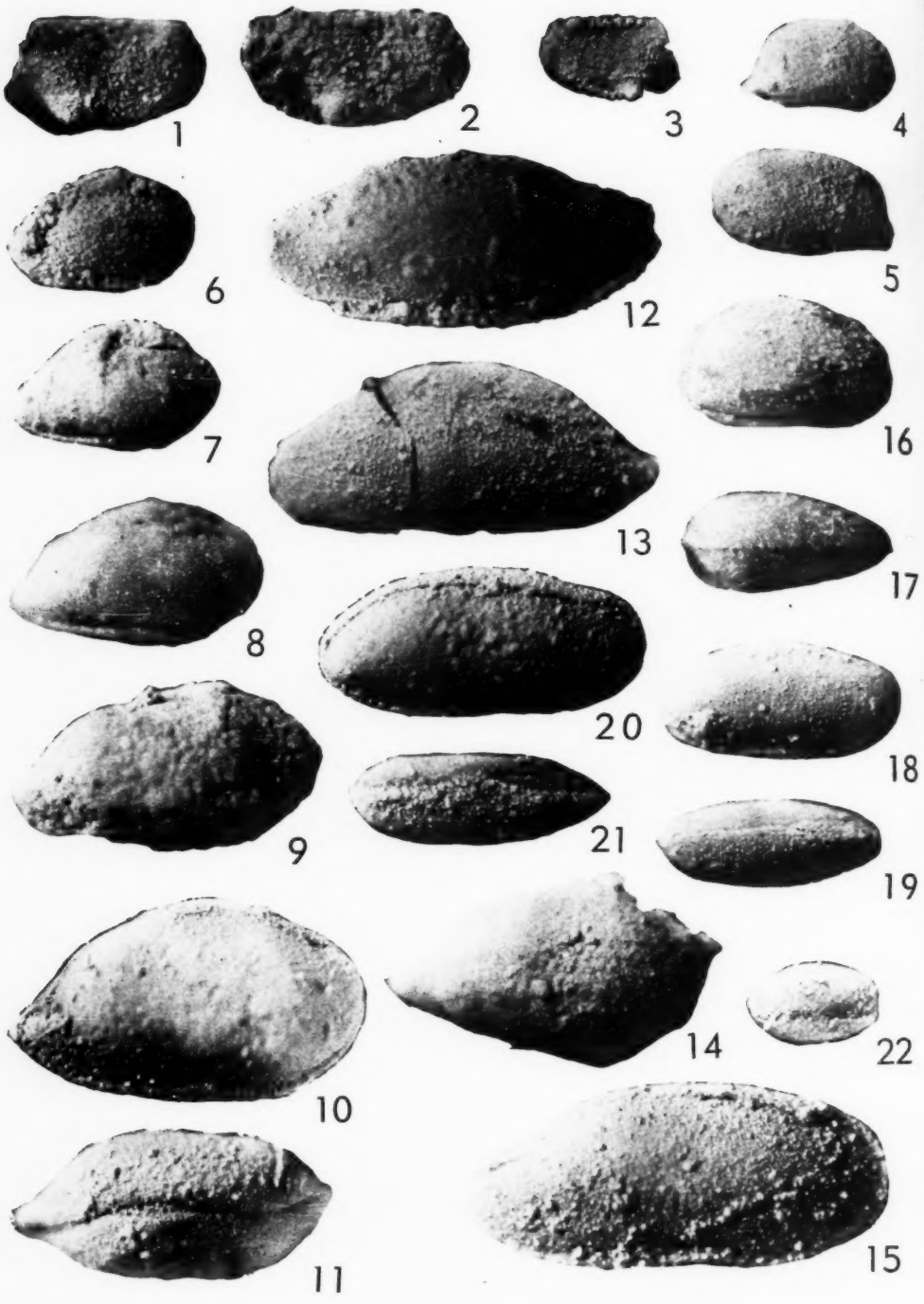
FIGS. *1–4*—*Praeammoastuta alberdingi* Bursch, n. gen., n. sp., type locality at new highway from city of San Cristóbal to town of San Antonio, State of Táchira, western Venezuela, León formation, upper Eocene. *1*, holotype, microspheric specimen, transmitted light. ×130; *2*, topotype, megalospheric specimen, reflected light, ×100; *3*, *4*, topotypes, megalospheric specimens, transmitted light, ×100. (p. 917)

5, *6*—*Ammoastuta salsa* Cushman and Brönnimann, paratype, Br. 644, Ortoire River, South Trinidad, B. W. I., Recent, brackish water, ×100. *5*, apertural view to show slit-like aperture and part of supplementary, cribrate aperture; *6*, side view to show cribrate aperture at lower end of last chamber which encloses corresponding parts of preceding adult chambers. (p. 922)

7, *8*—*Haplophragmium cassis* Millett, not Parker, copied from drawing of Millett (1899, pl. 5, fig. 6), Malay Archipelago, Recent, ×180; *7*, side view; *8*, end view of last-formed chamber.



Bursch, Venezuelan Tertiary Foraminifera



Marple, Pennsylvanian Ostracodes from Ohio

with the old road connecting the towns.

Type stratum.—Light-gray to greenish-gray, buff- to reddish-weathering shales with interbedded, gypsiferous shales of the León formation of Oligocene age. Dip 25°, strike N30E.

Occurrence.—The species has been found at two additional localities: in a road cut located 300 m. southeast of the type locality in shales of the León formation, and in a cutting from the lower part of the Chaguaramas formation (fig. 2) at a depth of 5080 feet in the Tux-9 well, State of Guárico.

Remarks.—Comparative study of paratypes of *Ammoastuta salsa* Cushman and Brönnimann revealed that in the proposal of the species this foraminifer was apparently inaccurately described as the earliest portion of the test being planispiral and closely coiled, and the aperture consisting of a series of very minute pores. Because these morphological features are of major taxonomic significance for the species as well as for the genus of which this species is the genotype, an emended definition of *Ammoastuta salsa* is required, and a revised diagnosis of the genus is presented below.

Genus AMMOASTUTA Cushman and Brönnimann, 1948

Genotype—Ammoastuta salsa Cushman and Brönnimann.

Emended diagnosis.—Test curved-uniserial, subflabelliform, peripheral margin rounded; chambers simple, close-set in curvilinear arrangement, lengthening as added, juvenile chambers small, relatively narrow, adult chambers elongate, curved, each forming about half the periphery of the test, their lower ends bulging and enclosing corresponding portions of preceding adult chambers, the ephebic chamber series partly based upon the inner flank of the curved juvenarium; wall arenaceous, relatively smooth; apertures of two kinds, one a slit approximately parallel to the axis of curving, located at or near the middle of the apertural face, the other cribrate, perforating the bulging lower end of the last chamber; the shape of both apertures corresponds with that of the internal passages between the adult chambers.

Relationships.—The Recent genus appears closely related to the Tertiary *Praeammoastuta*, n. gen., from which it may have been derived, and from which it differs in having a supplementary aperture and a reduced number of juvenile chambers. The writer disagrees with the original assignment of the genus to the Lituolidae (Cushman and Brönnimann, 1948, p. 17; Cushman, 1948, p. 106), because it lacks a closely-coiled early growth stage. Due to the uniserial arrangement of the juvenile chambers, the genus is tentatively placed in the family Reophacidae, subfamily Reophacinae.

Occurrence.—The known occurrence of

EXPLANATION OF PLATE 133

All magnifications ×40.

FIGS. *1, 2—Monoceratina bradfieldi* Cooper. *1*, lateral view; Poverty Run member, locality 12; *2*, lower Mercer limestone member, locality 22. (p. 927)

3—Monoceratina macoupeni Scott and Borger. Lateral view; lower Mercer limestone member, locality 12. (p. 927)

4, 5—Bairdia altifrons Knight. *4*, lateral view, right valve; *5*, left valve; both from lower Mercer limestone member, locality 14. (p. 929)

6–11—Bairdia oklahomaensis Harlton. *6–10*—Lateral views, ontogenetic series; *11*, hinge view; lower Mercer limestone member, locality 12. (p. 930)

12—Bairdia glennensis Harlton, lateral view; lower Mercer limestone member; locality 15. (p. 930)

13—Bairdia schaurothiana Kirkby, lateral view; lower Mercer limestone member; locality 14. (p. 930)

14—Bairdia pennata Coryell and Sample. Lower Mercer limestone member, locality 15. (p. 930)

15—Bairdiacypris trojana (Wilson). Lower Mercer limestone member, locality 20. (p. 931)

16, 17—Bythocypris pediformis Knight, *16*, lateral view; *17*, lateral view; *17*, hinge view; lower Mercer limestone member, locality 14. (p. 931)

18, 19—Fabalicypris minuta Cooper. *18*, lateral view; *19*, ventral view; lower Mercer limestone member, locality 13. (p. 931)

20, 21—Fabalicypris wetumkaensis Cooper. *20*, lateral view; *21*, ventral view; lower Mercer limestone member, locality 14. (p. 932)

22—Microcheilinella minuta Cooper. Lateral view; lower Mercer limestone member, locality 20. (p. 932)

the genus is Recent, and it appears to be restricted to tropical America: Mangrove swamps and Ortoire River on Trinidad, B. W. I.; Piñas Bay, Panama (at a depth of 12 fathoms); and off Puna, Ecuador, at a depth of 6 fathoms.

AMMOASTUTA SALSA Cushman and Brönnimann
Plate 132, figs. 5, 6; text-fig. 4

Emended diagnosis.—Test curved-uniserial, subflabelliform, peripheral margin rounded, slightly lobate in most specimens;

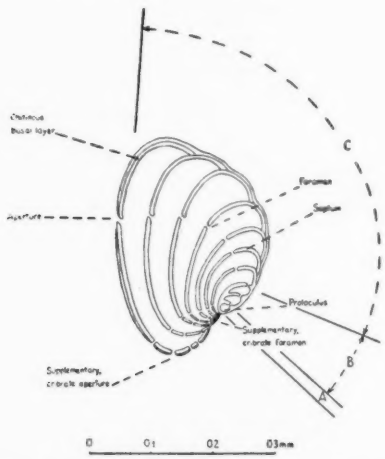


FIG. 4—General appearance of a median section of the test of *Ammoastuta salsa* Cushman and Brönnimann, A-Form (diagrammatic). Growth stages: A, Embryonic. B, Juvenile. C, Adult.

chambers distinct, simple, close-set in curvilinear arrangement, lengthening as added, their sutures slightly depressed or flush with the surface of the test, juvenarium distinctive from adult growth stage by the size, shape, and position of its chambers which are small, narrow, subtriangular in side view, and laterally border the base of the ephebic growth stage, adult chambers elongate, curved, each forming about half the periphery of the test, their lower ends inflated and enveloping corresponding portions of foregoing, adult chambers, ephebic chamber series partly based upon the inner flank of the curved juvenarium; wall opaque, relatively smooth, consisting of a chitinous, basal layer with incrusted, arenaceous matter at the surface; apertures of two kinds, a primary aperture consisting of a slightly curved or straight slit, approximately parallel to the axis of curving, located at or slightly above the middle of the apertural face, and a supplementary, cribrate aperture, perforating the bulging, lower end of the last-formed chamber; the shape of both apertures corresponds with that of the internal passages between the adult chambers.

Additional descriptive data.—The length of the slit-like aperture attains 0.05 mm. (compare also Cushman and Brönnimann, 1948, pl. 3, fig. 16b). An elongate flange at the base of the aperture can be observed in some specimens (Pl. 132, fig. 5). The diameter of the cribrate aperture varies between 0.05 and 0.09 mm., the diameter of its individual openings between 5 and 10 microns.

Among thirty paratypes available to the writer, no microspheric test has been detected. The numbers of juvenile and adult chambers appear to vary, respectively, from 1 to 3 and from 5 to 9 (numbers of corresponding chambers of *Praeammoastuta alberdingi*, n. sp., A-form, 1 to 5 and 6 to 11, respectively). The length of the test (which corresponds to the length of the last chamber) varies between 0.31 and 0.48 mm.; breadth, 0.14–0.32 mm.; and thickness, 0.07–0.12 mm. Length and breadth of holotype, according to Cushman and Brönnimann (1948, pl. 3, fig. 14), 0.40 and 0.22 mm., respectively. Major morphologic and numerical differences between the juvenile and ephebic growth stages are tabulated (table 2).

Relationships.—According to Cushman and Brönnimann (1948, p. 17), the species differs from *Ammoastuta inepta* (Cushman and McCulloch) in its larger size and particularly in its much broader form. Due to scarcity of type material and because the holotype has been lost (McCulloch, personal communication, May 22, 1950), no types of the latter species could be made available to the writer, but the differences mentioned above are shown by the figures accompanying the description of both species.

Cushman and McCulloch (1939, p. 89) mention that *Ammoastuta inepta* in some respects resembles a Recent Malayan foraminifer figured by Millett (1899, pl. 5, figs. 6a, b) under the name *Haplophragmium*

TABLE 2.—DISTINCTIVE CHARACTERS OF THE JUVENILE AND ADULT GROWTH STAGES OF *Ammoastuta salsa* CUSHMAN AND BRÖNNIMANN

	Shape	Rel. Size	Location	Number of Chambers	Shape of Chambers	Rel. Size of Ch.	Foramina
Juvenile Growth Stage	Short, narrow, curved uniserial	Minute portion of test	Peripheral, inner flank borders adult growth stage	1 to 3	Narrow, subtriangular in side view	Small	Located at the distal part of the septa
Adult (Ephebic) Growth Stage	Subflabelliform	Major portion of test	Based upon embryonic and adult growth stages	5 to 9	Elongate, gently curved; lower, bulging end encloses corresponding parts of preceding adult ch.	Large	Located at or near the middle of the septa; supplementary cribrate foramina located at the lower end of the ch.

cassis Parker. This illustration is copied on Pl. 132, figs. 7 and 8 of this report. The broken test appears to be multiform of the kind which is found in the *Praeammoastuta-Ammoastuta* group, i.e., the mixed types of growth are not due to a variable arrangement of the chambers at successive phases of individual development, but primarily to the distinctive shape and size of the chambers at different growth stages. Moreover, also in Millett's specimen the adult chamber series apparently flanks the juvenarium. The specimen seems to resemble *Praeammoastuta* in more respects than *Ammoastuta* if the apparent absence of a supplementary, cribrate aperture at the base of the last-formed chamber and the number of juvenile chambers are taken into consideration. This number (7 or 8) even exceeds the maximum number of corresponding chambers of *Praeammoastuta alberdingi* which in turn possesses more juvenile chambers than *A. salsa*. Besides, the growth axes of both juvenile and ephebic stages appear less curved than the corresponding axes of either *Praeammoastuta* or *Ammoastuta*. In consideration of these points it does not seem improbable that Millett's form would represent a Recent specimen of a species which originated in pre-Recent time. This species might be ancestral to *A. salsa* and perhaps also to *Praeammoastuta alberdingi*.

Holotype.—Cushman Lab. Foram. Research, Contr., vol. 24, pt. 1, 1948, p. 17, pl. 3, fig. 14; Cushman Coll. No. 56638; inshore mud, brackish water, Mangrove swamp, west coast of Trinidad, B. W. I.

REFERENCES

CUSHMAN, J. A., 1948. The Foraminifera, their classification and economic use. 4th ed., Harvard Univ. Press, pp. 1–605, pls. 1–31; Key, pls. 1–55; text-figs.

——, and BRÖNNIMANN, P., 1948, Some new genera and species of Foraminifera from brackish water of Trinidad: Cushman Lab. Foram. Research, Contr., vol. 24, pt. 1, pp. 15–20.

——, and MCCULLOCH, I., 1939, A report on some arenaceous Foraminifera: Allan Hancock Pac. Exped., vol. 6, no. 1, Univ. Cal. Press, pp. 1–113, pls. 1–12.

DUSENBURY, A. N., JR., 1949, The *Hannatoma* fauna in Colombia and Venezuela: Jour. Paleontology, vol. 23, pp. 147–149.

ELLIS, B. F., and MESSINA, A. R., 1940, Catalogue of Foraminifera (including supplements up to 1948): Am. Mus. Nat. History, New York, Spec. Publ.

GLAESSNER, M. F., 1945, Principles of micropaleontology: Melbourne Univ. Press, pp. 1–296, pls. 1–14, tables 1–7, text-figs. 1–64.

MILLETT, F. W., 1899, Report on the Recent Foraminifera of the Malay Archipelago, collected by Mr. A. Durrand, F.R.M.S. Pt. V: Jour. Roy. Micr. Soc.

NOTESTEIN, F. B., HUBMAN, C. W., and BOWLER, J. W., 1944, Geology of the Barco Concession, Republic of Colombia, South America: Geol. Soc. America, Bull., vol. 55, pp. 1165–1216, 6 pls., 12 text-figs., map.

SCHAUB, H. P., 1948, Outline of sedimentation in Maracaibo basin, Venezuela: Amer. Assoc. Petrol. Geol., Bull., vol. 32, pp. 215–227.

SUTTON, F. A., 1946, Geology of Maracaibo basin, Venezuela: Amer. Assoc. Petrol. Geol., Bull., vol. 30, pp. 1621–1741, pls. 1–9, text-figs. 1–11, map.

JOURNAL OF PALEONTOLOGY, VOL. 26, NO. 6, PP. 924–940, PLS. 133–135, 4 TEXT FIGS., NOVEMBER 1952

OSTRACODES FROM THE POTTSVILLE SERIES IN OHIO

MILDRED FISHER MARPLE
Ohio State University, Columbus, Ohio

ABSTRACT—Although the large fossils of the Pottsville Series in Ohio have been well known for many years, this is the first study of ostracodes from these rocks. Thirty-eight species belonging to 19 genera and 9 families were found in the marine portions of three of the cyclothems of the upper or Kanawha portion of the series. One species is new.

INTRODUCTION

DURING the past quarter-century numerous papers dealing with Pennsylvanian ostracodes have appeared. Most of these are based on material from rocks of late Pennsylvanian age from Texas, the Mid-Continent and the Illinois basins of deposition. The ostracodes discussed in this report are from the Pottsville, the lowest of the four major divisions of the Pennsylvanian in Ohio. This is the first paper to deal with species from marine deposits of this age in the Appalachian basin.

Pottsville rocks crop out in a broad band extending some 200 miles across eastern Ohio. In common with many other strata of Pennsylvanian age they may be grouped in sequences called cyclothems. It is the practice to name each cyclothem for the coal seam which it contains. Many of the Pottsville cyclothems are incomplete. Although there are fossiliferous marine iron ores and black shales occurring in the lower Pottsville at the points in the cyclothems where, ideally, a marine limestone should appear, none of the samples obtained from these members yielded ostracodes. These Crustacea were found, however, in some abundance in three of the four marine limestones of the upper Pottsville and in the marine shales associated with them. Specimens discussed in this paper were obtained from approximately 100 samples taken at 23 localities distributed over the length of the outcrop belt (see fig. 1).

The Lowellville, or Poverty Run (fig. 2), is the oldest Pennsylvanian limestone in Ohio and the lowest member in which ostracodes were found. It occurs only in two isolated areas, one in northeastern Ohio in Mahoning County, the other near the middle of the outcrop belt in Muskingum County. No ostracodes were found in samples of this member from the first of these areas. In the second, however, 20 species were identified from the limestone and from the dark marine shales lying immediately above and below it. The prominence of the Kirkbyidae and the sparse representation of the Healdiidae in this member are in sharp contrast to the ostracode faunas which occur higher up in the section. The position of the Lowellville-Poverty Run as compared to ostracode-bearing limestones in Illinois is not certain. Upon present evidence of the ostracodes alone it might appear that it could be correlated with the Fulda limestone. However, the Poverty Run lies above a coal which, on paleobotanical evidence, is well up in the Kanawha portion of the series in the zone of *Neuropteris tenuifolia*, whereas the Fulda lies in the zone of *Mariopteris pygmea* or upper Morrowan (Moore et al, 1944, p. 669).

The Boggs, which is the next marine member above the Poverty Run, varies greatly in lithology from place to place, being locally an arenaceous or siliceous limestone, a flint, a shale or an iron ore. It is sparingly fossiliferous but no samples obtained from it contained ostracodes.

The most persistent member of the Pottsville is the lower Mercer limestone (fig. 3) which can be traced for more than 200 miles across the state from its type area in Mercer County, Pennsylvania, to the hills of southern Ohio above the Ohio River in Scioto County. In its most characteristic development the lower Mercer consists of two benches of dark-blue or black limestone separated by a shale parting which, in places, thickens to as much as 12 feet. A

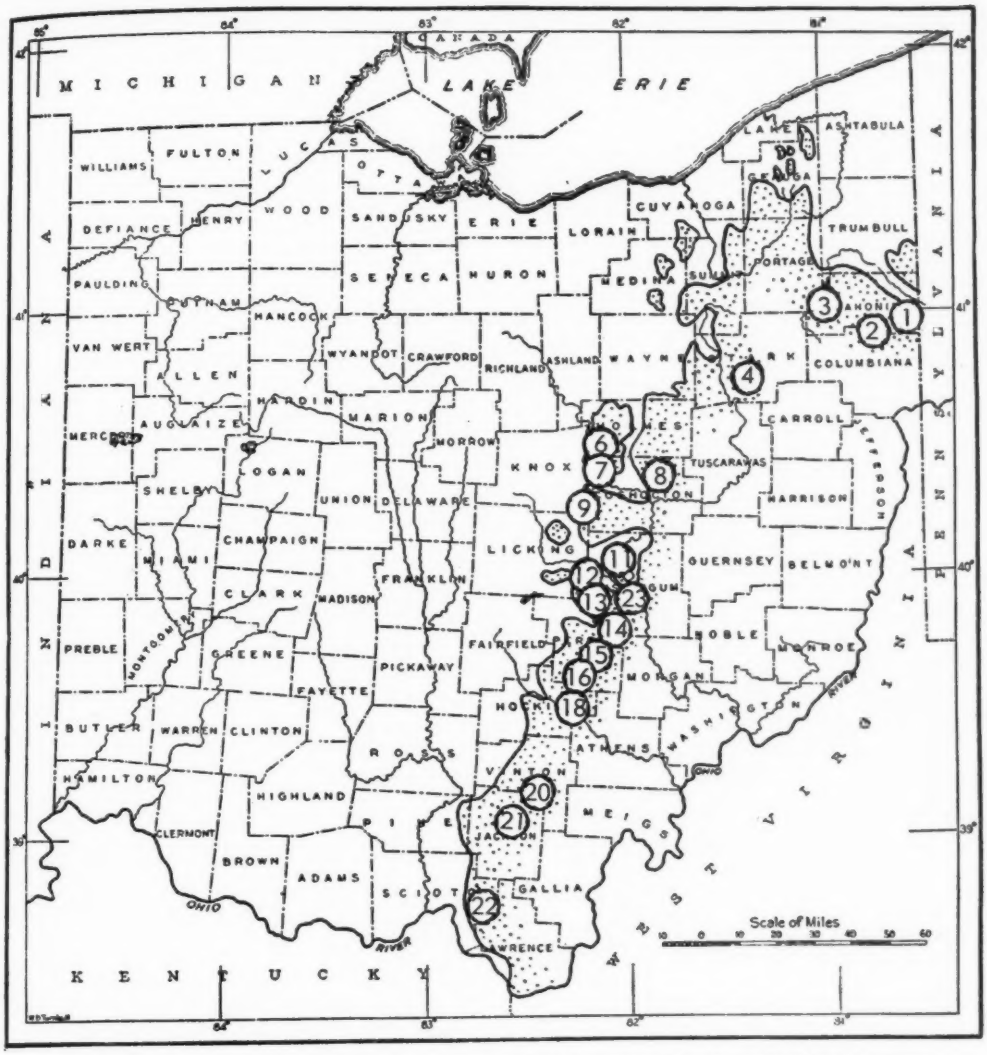


FIG. 1—Map of Ohio showing localities from which the ostracodes described in this paper were collected.

few inches to several feet of dark shale may separate the limestone from the underlying middle Mercer coal, whereas the lower Mercer or Little Red Block ore lies a few feet above the limestone, the interval being occupied by gray, fossiliferous, marine shales. Every unit, from the top of the coal to the top of the ore, contains ostracodes at the point along the outcrop. Of the 37 species identified from the lower Mercer, 20 appear to be limited to this cyclothem, although more intensive collecting would without doubt extend the ranges of at least some of these forms. This fauna seems to be closely allied to that of the Seville zone in Illinois, 21 species being common to both (Cooper, 1946, p. 20).

The upper Mercer limestone (fig. 4), uppermost marine member of the Pottsville, is less persistent and more variable than the lower Mercer. In many places it is a black flint from which the ostracodes were freed with difficulty. From its more shaly facies however, seven species were collected,

six of which were also found in the lower Mercer. Wanless (1939, p. 53) has sought to demonstrate the equivalence of the upper Mercer limestone of Ohio and the Winefrede limestone of West Virginia, largely on lithologic and stratigraphic criteria. Until something is known of the ostracode faunas of the West Virginia limestones these forms can be of no service in aiding in correlation.

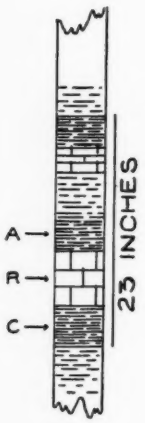


FIG. 2—Section of part of the marine portion of the Vandusen cyclothem showing observed abundance of ostracodes in the Poverty Run member at locality 12. Lesser abundance of forms in the tough, blocky limestone is probably due to the difficulty of their extraction. A=abundant; C=common; R=rare.

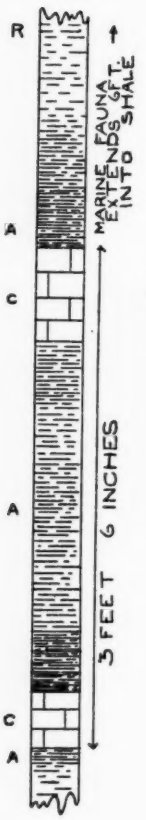


FIG. 3—Section of part of the middle Mercer cyclothem at locality 20 showing ostracode-bearing beds associated with the lower Mercer limestone. The greater abundance of ostracodes in the shales is more apparent than real due to the difficulty of extraction. A=abundant; C=common; R=rare.

STRATIGRAPHIC RELATIONSHIPS

The known stratigraphic and geographic occurrences of the ostracodes here reported from the Pottsville series are summarized in table 1, pp. 928–929.

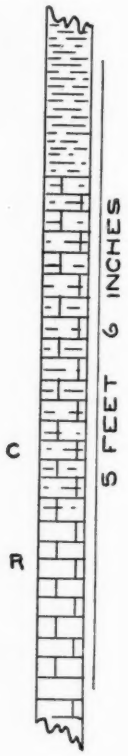


FIG. 4—Section of part of the Bedford cyclothem at locality 6. This is the only portion of the upper Mercer limestone from which ostracodes were recovered in any abundance. Here the upper Mercer is represented by a limestone which is argillaceous in its upper part. In most localities the member is a flint or a flinty limestone. C=common; R=rare.

ACKNOWLEDGMENTS

The kindness and help of many people have furthered this project. Mr. Wilber Stout, former state geologist, has given freely of his great fund of knowledge of Ohio geology. Mr. Raymond Lamborn, of the Ohio Division of Geological Survey, has also suggested collecting localities and use has been made of the Survey's file of stratigraphic sections. Through Dr. H. B. Willman, type specimens deposited with the State Geological Survey of Illinois were

made available for comparison. Mrs. Betty Kellett Nadeau examined some of the material and offered suggestions on problems of taxonomy. Special thanks are due Dr. Grace Anne Stewart of Ohio State University under whose direction this study has been made.

LIST OF LOCALITIES FROM WHICH COLLECTIONS WERE MADE

1. Mahoning County, Poland Township, Grindstone Run.
2. Mahoning County, Poland Township, Poland Village; west bank of Yellow Creek behind first house north of bridge north of town.
3. Mahoning County, Berlin Township, two miles west of Berlin Center; north bank of Little Mill Creek.
4. Stark County, Pike Township, Section 2; along old brick road north of Howenstein.
6. Holmes County, Richland Township, Section 13; NE¼; at junction of road and the lane which enters from the east.
7. Holmes-Coshocton county line road, between Section 23, Richland Township, Holmes County, and Section 3, Tiverton Township, Coshocton County.
8. Coshocton County, Keene Township, Section 10; road at northeast corner.
9. Coshocton County, Newcastle Township; ravine one mile east of Newcastle on north side of Route 715.
11. Muskingum County, Falls Township; ravine west of Route 145 two miles north of Dillon.
12. Muskingum County, Hopewell Township; Poverty Run.
13. Muskingum County, Hopewell Township, Section 18, NW¼; ditch at angle of road in ravine and in first gully on east side of stream south of road.
14. Muskingum-Perry County line; valley of tributary of Johnathan Creek on line between Madison Township, Perry County and Newton Township, Muskingum County.
15. Perry County, Somerset; Baltimore and Ohio Railroad cut.
16. Perry County, Reading Township, Section 22; road ditch on Route 668, two miles south of Somerset.
18. Hocking County, Falls Gore Township, Section 31; abandoned pit of Logan Clay Products Company on south side of road, three-fourths mile east of Route 75.
20. Vinton County, Elk Township Section 32, NE¼; in valley at fork of stream.
21. Jackson County, Coal Township; ditch at culvert at junction of Route 785 and road leading to Davisville.
22. Scioto County, Vernon Township; two miles south of Lyra, in bank above the old road.
23. Muskingum County, Salt Creek Township; Ohio Engineering Experiment Station well core.

SYSTEMATIC DESCRIPTIONS

Order OSTRACODA Latreille, 1802
Family ACRONOTELLIDAE Swartz, 1936
Genus MONOCERATINA Roth, 1928

MONOCERATINA BRADFIELDI Cooper
Plate 133, figs. 1, 2

Monoceratina n. sp. BRADFIELD, 1935, Bull. Am. Paleontology, vol. 22, p. 77, pl. 1, figs. 16–18; Deese group, Oklahoma.
Monoceratina bradfieldi COOPER, 1946, Illinois Geol. Survey Bull. 70, p. 39, pl. 1, figs. 4–6; Little Vermilion cyclothem, Illinois.

Measurements.—The figured specimen has the following dimensions: length, 0.82 mm.; height, 0.41 mm.

Remarks.—*Monoceratina bradfieldi* is distinguished by its nearly equally inflated anterior and posterior. The posterior is unusually wide for the genus. The Ohio specimens are slightly larger than those from Illinois but are smaller than the maximum of the Oklahoma measurements. Well-preserved shells are found in some abundance in the shale immediately over the Poverty Run limestone and they are not uncommon in the lower Mercer limestone.

Distribution.—Lowellville (Poverty Run) limestone, locality 12; lower Mercer limestone, localities 18 and 22.

MONOCERATINA MACOUPENI Scott and Borger
Plate 133, fig. 3

Monoceratina macoupeni SCOTT and BORGER, 1941, Jour. Paleontology, vol. 15, p. 355, pl. 49, figs. 2, 3; Macoupin formation, Illinois.
Monoceratina lawrencevillensis SCOTT and BORGER, 1941, Jour. Paleontology, vol. 15, p. 355, pl. 49, figs. 8, 9; Macoupin formation, Illinois.

Measurements.—Averages of five specimens with the restoration of the posterior estimated; length, 0.67 mm.; height, 0.30 mm.

Remarks.—This is the more abundant species of the genus *Monoceratina* in the samples studied. Good specimens are relatively rare, however, as the shell is delicate and easily distorted or broken. No bivalved specimens were found. The species may be recognized by the length and sharpness of the spine, the coarse, granular pattern on the ventral portion of the keel and the prominent antero-dorsal node with a row of smaller, diminishing nodes along the dorsal margin.

TABLE 1.—KNOWN STRATIGRAPHIC AND GEOGRAPHIC DISTRIBUTION OF OSTRACODES DISCUSSED IN THIS PAPER

	Ohio			Illinois				Missouri	Kansas	Nebraska	Oklahoma							Texas		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Acronotellidae																				
Monoceratina bradfieldi Cooper	×	×					×									×				
Monoceratina macoupeni Scott and Borger	×	×					×													
Bairdiidae																				
Bairdia altifrons Knight		×				×		×												
Bairdia glennensis Harlton		×		×				×	×							×				
Bairdia oklahomaensis Harlton	×	×		×		×				×				×		×	×	×	×	×
Bairdia pennata Coryell and Sample		×			×	×														×
Bairdia schaurothiana Kirkby		×			×															
Bairdiacypris trojana (Wilson)		×		×									×							
Bythocypris pediformis Knight	×	×	×			×		×	×	×			×	×	×	×			×	×
Bythocypris pediformis var. *parallela* Knight	×	×					×									×				×
Fabalicypris minuta Cooper		×				×														
Fabalicypris wetumkaensis Cooper	×	×	×		×	×														
Fabalicypris wileyensis Cooper		×	×		×	×														
Microcheilinella minuta Cooper		×				×														
Cytherellidae																				
Cavellinella casei Bradfield		×													×					
Sulcella sulcata Coryell and Sample (?)		×				×			×	×										×
Healdiidae																				
Healdia elegans Warthin	×	×	×			×								×						
Healdia fabalis Cooper		×	×			×														
Healdia glennensis Harlton		×				×					×						×			×
Healdia cf. *H. glennensis* Harlton	×	×																		
Healdia longula Cooper		×				×								×						×
Healdia sp.		×			×															
Hollinellidae																				
Hollinella dentata Coryell	×			×		×								×		×				×
Kirkbyidae																				
Amphissites centronotus (Ulrich and Bassler)	×	×				×		×	×	×				×		×			×	×
Amphissites cf. *A. congruens* Cooper	×						×													
Amphissites rugosus Girty	×	×					×													
Ectodemites harltoni Cooper	×			×		×														
Polytylites trilobus Croneis and Gale	×						×													
Kirkbya kellettae Harlton	×			×	×	×														
Kirkbyella cf. *K. gutkei* Croneis and Gale	×	×		×																

TABLE 1—*Continued*

	Ohio			Illinois				Missouri	Kansas	Nebraska	Oklahoma							Texas		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Kloedenellidae																				
Jonesina arcuata (Bean)	×						×	×									×			
Jonesina biformis Bradfield	×	×				×										×				
Sansabella stewartae n.sp.		×																		
Leperditellidae																				
Microparaparchites elongatus Cooper	×		×				×													
Youngiellidae																				
Moorites elongatus ? (Jones and Kirkby)		×					×													
Moorites knighti ? (Wilson)		×				×														
Moorites minutus (Warthin)		×	×			×			×					×		×				
Moorites spiciferus (Wilson)		×				×						×								
Moorites wapanuckensis (Harlton)		×				×					×									

1. Ohio, Poverty Run limestone member.
2. Ohio, lower Mercer limestone member.
3. Ohio, upper Mercer limestone member.
4. Illinois, Fulda zone; Cooper, 1946.
5. Illinois, Ferdinand zone; Cooper, 1946.
6. Illinois, Seville zone; Cooper, 1946.
7. Illinois, miscellaneous zones; Cooper, 1946.
8. Missouri, Henrietta limestone; Knight, 1928.
9. Kansas, Upper Pennsylvanian and Permian; Kellett, 1934.
10. Nebraska, Missouri series; Johnson, 1936.
11. Oklahoma, Fayetteville, Springer; Harlton, 1929.
12. Oklahoma, Johns Valley shale; Harlton, 1933.
13. Oklahoma, McAlester shale; Wilson, 1933.
14. Oklahoma, Wetumka, Wewoka and Holdenville; Warthin, 1930.
15. Oklahoma, Ardmore Basin, Dornick Hills gp.; Bradfield 1935.
16. Oklahoma, Ardmore Basin, miscellaneous zones; Bradfield, 1935.
17. Oklahoma, Hoxbar group; Harlton, 1928.
18. Texas, Menard County; Harlton, 1929.
19. Texas, Wayland shale; Coryell and Billings, 1932.
20. Texas, East Mountain shale; Coryell and Sample, 1932.

The Ohio form appears to lie somewhere between *M. macoupeni* Scott and Borger and an unnamed *Monoceratina* described and figured by Bradfield (1935, p. 77, pl. 1, fig. 20) from the Deese (?) formation near Ardmore, Oklahoma. In Bradfield's species the spine is directed more toward the posterior and two rounded tubercles are situated near the anterior cardinal angle.

Distribution.—Lowellville (Poverty Run) member, locality 12; lower Mercer limestone member, localities 12, 13, 14 and 18.

Family BAIRDIIDAE Sars, 1887

Genus BAIRDIA M'Coy, 1884

BAIRDIA ALTIFRONS Knight

Plate 133, figs. 4, 5

Bairdia altifrons KNIGHT, 1928, Jour. Paleontology, vol. 2, p. 324, pl. 43, figs. 6a, b; upper Fort Scott formation, Missouri.

—— KELLETT, 1934, Jour. Paleontology, vol. 8, p. 135, pl. 18, figs. 6a, b; Fort Scott formation, Kansas.

—— JOHNSON, 1936, Nebraska Geol. Survey, Paper 11, p. 42, pl. 4, figs. 4, 5; Stanton formation, Nebraska.

—— COOPER, 1946, Illinois Geol. Survey, Bull.

70, p. 40, pl. 1, figs. 20–22; Seville to Shumway zones, Illinois.

Measurements.—Only single valves of this species were found. The following measurements are from different individuals. Left valve shown in Plate 133, fig. 5: length, 0.56 mm.; height, 0.30 mm. Right valve shown in Plate 133, fig. 4: length, 0.46 mm.; height, 0.26 mm.

Remarks.—The small size and absence of bivalved specimens suggest that these shells are immature moults. They agree very well with the plates and descriptions listed above but not with *B. hoxbarensis* Harlton which is considered by some authors to be synonymous with *B. altifrons*.

Distribution.—Lower Mercer limestone member, locality 14. Rare.

Bairdia glennensis Harlton
Plate 133, fig. 12

Bairdia glennensis Harlton, 1927, Jour. Paleontology, vol. 1, p. 210, pl. 33, fig. 10; upper Glenn formation, Oklahoma.
—— Cooper, 1946, Illinois Geol. Survey, Bull. 70, p. 45, pl. 2, figs. 6, 7; Fulda to Seahorn zones, Illinois.

Measurements.—The figured specimen has the following measurements: length, 1.38 mm.; height, 0.56 mm.

Remarks.—This species has a range from Lower Pennsylvanian into the Permian. However, only one reasonably good specimen (that figured) was found in the samples. Several fragments of a species of long *Bairdia* were found but their identification is tentative. The form ratio of *B. glennensis* is described as showing considerable variation but its unusual length is its most distinguishing characteristic.

Distribution.—Lower Mercer limestone member, locality 15.

Bairdia oklahomaensis Harlton
Plate 133, figs. 6–11

Bairdia oklahomaensis Harlton, 1927, Jour. Paleontology, vol. 1, p. 209, pl. 33, fig. 7; Glenn formation, Oklahoma.
—— Cooper, 1946, Illinois Geol. Survey, Bull. 70, p. 48, pl. 3, figs. 15, 16; Fulda to Macoupin zones, Illinois.

Remarks.—The articles cited by no means exhaust the literature on this prolific and long-ranging species. *B. oklahomaensis* is found throughout the Pennsylvanian in Illinois and the Mid-Continent and is reported from nearly every collection from Texas to Ohio. Variation in detail is inevitable among so many individuals but the species may be recognized by the acutely arched dorsum, the swelling on the posterior slope, the low, small posterior beak and the high anterior termination.

Five specimens of this species figured on Plate 133 of this report have been arranged in what is believed to be a series of moults, and have the following measurements:

Fig.	Length	Height	Width
6	0.53 mm.	0.33 mm.	0.17 mm.
7	0.61 mm.	0.38 mm.	0.25 mm.
8	0.71 mm.	0.46 mm.	0.30 mm.
9	0.92 mm.	0.56 mm.	0.41 mm.
10	1.10 mm.	0.66 mm.	0.51 mm.

Distribution.—Lowellville (Poverty Run) member, localities 11 and 12; lower Mercer limestone member, localities 1, 3, 12, 13, 15, 18, 20 and 23. Abundant.

Bairdia pennata Coryell and Sample
Plate 133, fig. 14

Bairdia angulata Coryell and Sample, 1932 (not Brady, 1870), Am. Midland Naturalist, vol. 13, p. 262, pl. 25, fig. 16; East Mountain shale, Texas.
Bairdia pennata Coryell and Sample, idem, vol. 14, p. 187.
—— Cooper, 1946, Illinois Geol. Survey, Bull. 70, p. 49, pl. 3, figs. 1–4; pl. 4, figs. 3, 4; Ferdinand to Shoal Creek zones, Illinois.

Measurements.—Figured specimen: length, 0.97 mm.; height, 0.51 mm.

Remarks.—No bivalved specimens of this form were found. All the individuals from locality 14 are young moults but those from other localities are adults. The shells are well preserved though frequently broken in removal from the matrix.

Distribution.—Lower Mercer limestone member, localities 14, 15 and 20.

Bairdia schaurothiana Kirkby
Plate 133, fig. 13

Bairdia schaurothiana Kirkby, 1858, Ann. and Mag. Nat. History, p. 329, pl. 10, fig. 14; Permian, British Isles.
—— Cooper, 1946, Illinois Geol. Survey, Bull. 70, p. 50, pl. 3, figs. 21–24; Seville zone, Illinois.

Measurements.—Length of figured specimen, 1.18 mm.; height, 0.51 mm.

Remarks.—Only a single left valve was found. One would hesitate to make an iden-

tification on such meager material but comparison with Cooper's type specimen leaves no doubt that the Illinois *B. schaurothiana* and the Ohio specimen belong to the same species.

Distribution.—Lower Mercer limestone member, locality 14.

Genus BAIRDIACYPRIS Bradfield, 1935
BAIRDIACYPRIS TROJANA (Wilson)
Plate 133, fig. 15

Bairdia trojana WILSON, 1933, Jour. Paleontology, vol. 7, p. 418, pl. 50, figs. 9a–c; McAlester shale, Oklahoma.

Bairdiacypris trojana COOPER, Illinois Geol. Survey, Bull. 70, p. 54, pl. 4, figs. 36–38; Fulda to Brereton zones, Illinois.

Measurements.—Dimensions of figured specimen: length, 1.22 mm.; height, 0.56 mm.; width, 0.35 mm.

Remarks.—The Ohio specimens are slightly fuller and blunter posteriorly than the Illinois type but otherwise are in close agreement. Although found at only two localities this species is not rare where it does occur.

Distribution.—Lower Mercer limestone member, localities 18 and 20.

Genus BYTHOCYPRIS Brady, 1880
BYTHOCYPRIS PEDIFORMIS Knight
Plate 133, figs. 16, 17

Bythocypris pediformis KNIGHT, 1928, Jour. Paleontology, vol. 2, p. 327, pl. 44, figs. 3a–c; Labette formation, Missouri.

—— WARTHIN, 1930, Oklahoma Geol. Survey, Bull. 53, p. 74, pl. 6, figs. 6a, b; Wetumka, Wewoka and Holdenville formations, Oklahoma.

—— WILSON, 1933, Jour. Paleontology, vol. 7, p. 419, McAlester shale, Oklahoma.

—— KELLETT, 1935, Jour. Paleontology, vol. 9, p. 135, pl. 16, figs. 8a–f; Lower Pennsylvanian to Permian, Kansas.

—— JOHNSON, 1936, Nebraska Geol. Survey, Paper 11, p. 43, pl. 4, figs. 13–15; Fort Scott to Stearns formation, Nebraska.

Bythocypris parallela KNIGHT, 1928, Jour. Paleontology, vol. 2, p. 327, pl. 44, figs. 2a, b; Labette formation, Missouri.

Measurements.—Average of four adults: length, 0.61 mm.; height, 0.38 mm.; width, 0.26 mm.

Remarks.—Associated with the above are individuals which are more elongate and which have a low-arched dorsal margin meeting a straight posterior in a rounded, obtuse angle. There appears to be a complete gradation in the curvature of the dorsum, the angulation of the posteroventral curve and in size, from a length of 0.25 mm. to the average mentioned above.

There is a considerable doubt as to the validity of *B. parallela* as a species distinct from *B. pediformis*. Knight originally suggested that they might be variants of the same species because of the apparent gradation from one to the other. Wilson, Warthin, Kellett and Johnson have confirmed Knight's suggestion.

B. pediformis is represented by more individuals than any other species in our collection. At some localities only one principal type was found; at others a complete series of gradational forms. The designation *B. pediformis* var. *parallela* has been used to designate those localities in which the clearly elongate type were found. Such variations might be ascribed to age, sex, or differences occurring in a large, freely interbreeding population.

Cooper (1946, p. 58) placed these forms in the genus *Coryellites* under two species, a practice which may be questionable as they lack the ventral ridge and depression diagnostic of the genus *Coryellites*.

Distribution.—*B. pediformis* Knight (in the broad sense), Lowellville (Poverty Run) member, locality 12. Lower Mercer limestone member, localities 1, 7, 12, 13, 14, 20, 22 and 23. Upper Mercer limestone member, locality 6.

B. pediformis var. *parallela*, Lowellville (Poverty Run) member, localities 11 and 12. Lower Mercer limestone member, localities 12, 14, and 20.

Genus FABALICYPRIS Cooper, 1946
FABALICYPRIS MINUTA Cooper
Plate 133, figs. 18, 19

Fabalicypris minuta COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 60, pl. 5, figs. 31, 32.

Measurements.—Length, 0.71 mm.; height, 0.35 mm.; width, 0.26 mm.

Remarks.—Other species of *Fabalicypris* were found at every locality at which *F. minuta* was observed. In every respect excepting size it bears a strong resemblance to *F. wetumkaensis* Cooper, and it is suggested that these may be young individuals.

Distribution.—Lower Mercer limestone member, localities 7, 13 and 20. Common.

FABALICYPRIS WETUMKAENSIS Cooper
Plate 133, figs. 20, 21

Bairdia haworthi WARTHIN, 1930 (not Knight), Oklahoma Geol. Survey, Bull. 53, p. 73, pl. 6, figs. 4a, b; Wetumka formation, Oklahoma.
Fabalicypris wetumkaensis COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 61, pl. 6, figs. 12–19; Ferdinand to Collinsville zones, Illinois.

Measurements.—Average of three adults: length, 0.87 mm.; height, 0.35 mm.; width, 0.30 mm.

Remarks.—Well-preserved shells of this species are common in most of the samples in which they occur. It may be distinguished from *F. wileyensis* Cooper by its concave ventral margin and its greater form ratio.

Distribution.—Lowellville (Poverty Run) member, locality 12. Lower Mercer limestone member, localities 1, 12, 13, 14, 15, 18 and 20. Upper Mercer limestone member, locality 6.

FABALICYPRIS WILEYENSIS Cooper
Plate 134, figs. 1, 2

Fabalicypris wileyensis COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 61, pl. 6, figs. 4–8; Ferdinand to Summum zones, Illinois.

Measurements.—Figured specimen: length, 0.72 mm.; height, 0.61 mm.; width, 0.41 mm.

Remarks.—The strong, smooth shells of this form are common at many localities across the state. The specimens figured in this report are slightly fuller and more tumid than the Illinois type and, in consequence. show less centro-dorsal overlap.

Distribution.—Lower Mercer limestone member; localities 1, 2, 3, 14, 16, and 20. Upper Mercer limestone; localities 6 and 8.

Genus MICROCHEILINELLA Geis, 1932
MICROCHEILINELLA MINUTA Cooper
Plate 133, fig. 22

Microcheilinella minuta COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 63, pl. 6, figs. 47–49; Seville zone, Illinois.

Measurements.—Figured specimen: length, 0.46 mm.; height, 0.28 mm.; width, 0.25 mm.

Remarks.—The specimens under consideration agree very well with Cooper's type. They differ slightly in that the anterior is straighter and more nearly vertical and there is no spine as shown in Cooper's plate. However, Cooper does not mention a spine in his description.

Distribution.—Lower Mercer limestone member; localities 14 and 20. Rare.

Family CYTHERELLIDAE Sars, 1865
Genus CAVELLINELLA Bradfield, 1935
CAVELLINELLA CASEI Bradfield
Plate 134, figs. 4–6

Cavellinella casei BRADFIELD, 1935, Bull. Am. Paleontology, vol. 22, p. 136, pl. 12, figs. 11a, b; Dornick Hills formation, Oklahoma.

Measurements.—Small individuals show the following range in size:

Length	Height	Width
0.56 mm.	0.35 mm.	0.23 mm.
0.61 mm.	0.41 mm.	0.28 mm.

Large single valves have the following dimensions: length, 0.82 mm.; height, 0.58 mm.

Remarks.—Two sorts of material are referred to this species. The first consists of a group of eight bivalved specimens of the type illustrated on Plate 134, figs. 4 and 5. These have a range in size as mentioned above, the larger individuals showing a slightly fuller posterior and greater development of the posterior ridge than do the smaller. The second group of specimens consists of five single right valves (Plate 134, fig. 6) the average dimensions of which are given above. These show a slightly higher dorsal arching and more fully rounded posterior than do the smaller individuals. Comparison was made with Bradfield's holotype. Its dimensions (length, 0.59 mm.; height, 0.37 mm.; width, 0.24 mm.) will be seen to lie between the largest of the smaller specimens and the smallest of the larger individuals. In other characteristics the type is also intermediate. It is possible to arrange a series of four distinctly different forms, of which the holotype is number three, which are believed by the writer to be a moult series.

Distribution.—Lower Mercer limestone member, localities 14 and 20.

Genus SULCELLA Coryell and Sample, 1932
SULCELLA SULCATA Coryell and Sample (?)
Plate 134, fig. 7

Sulcella sulcata CORYELL and SAMPLE, 1932, Am. Midland Naturalist, vol. 13, p. 275, pl. 26, fig. 18; East Mountain shale, Texas.
—— COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 76, pl. 11, figs. 1–15; Seville to Newton cyclothems, Illinois.

Remarks.—Several single valves are assigned to this species with some question. They differ from each other in shape and size, yet all are elliptical in lateral outline, wedge-shaped in dorsal view and each possesses a sub-central pit which, in all but one specimen, opens into a shallow sulcus. Better material will be required for positive identification.

Distribution.—Lower Mercer limestone member, localities 12, 13, 14 and 20.

Family HEALDIIDAE Harlton, 1935
Genus HEALDIA Roundy, 1926
HEALDIA ELEGANS Warthin
Plate 134, fig. 13

Healdia elegans WARTHIN, 1930, Oklahoma Geol. Survey, Bull. 53, p. 76, pl. 6, figs. 11a, b; Wetumka formation, Oklahoma.
—— COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 82, pl. 12, figs. 19–21; Seville to Jamestown zones, Illinois.

Remarks.—No complete specimens of this form were found. Small, single valves of extreme delicacy are probably immature moults of this species. They show the high-arched dorsum with concave posterodorsal slope characteristic of *H. elegans*. No specimen shows more than one long, incurved spine.

Distribution.—Lower Mercer limestone member, localities 7, 12, 13, and 14; upper Mercer limestone member, locality 6. Rare.

HEALDIA FABALIS Cooper
Plate 134, figs. 8, 9

Healdia fabalis COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 82, pl. 12, figs. 3–5; Seville zone, Illinois.

Measurements.—Figured specimen: length, 0.61 mm.; height, 0.33 mm.; width, 0.26 mm.

Remarks.—The Ohio material compares very well with that from Illinois. Nothing further need be added to Cooper's description.

Distribution.—Lower Mercer limestone member, localities 7, 12, 13 and 14. Upper Mercer limestone member, locality 6.

HEALDIA GLENNENSIS Harlton
Plate 134, fig. 11

Healdia glennensis HARLTON, 1927, Jour. Paleontology, vol. 1, p. 209, pl. 33, figs. 6a, b; Glenn group, Oklahoma.
—— HARLTON, 1929, Am. Jour. Sci., Ser. 5, vol. 18, p. 263, pl. 2, fig. 4; Boggy formation, Oklahoma.
—— COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 83, pl. 12, figs. 1, 2; Seville to Brereton zones, Illinois.

Measurements.—Figured specimen: length, 0.58 mm.; height, 0.38 mm.; width, 0.28 mm.

Remarks.—This form is common in those localities in which it occurs at all. It will be discussed in some detail in connection with the variety which follows.

Distribution.—Lower Mercer limestone member, localities 7, 13 and 14.

HEALDIA GLENNENSIS Harlton var.
Plate 134, fig. 12

Measurements.—Average of three specimens: length, 0.49 mm.; height, 0.30 mm.; width, 0.25 mm.

Remarks.—This form is similar to *H. glennensis* but is of smaller size and bears no nodes or spines. It may be a young moult or it may be a variety of the species. Associated with these were found two specimens which have a form ratio of 2:1; a longer, straighter posterodorsal slope and a smaller ventral overlap.

Bradfield (1935, p. 112), in describing another *Healdia* similar to *H. glennensis*, mentions more slender, straighter forms associated with the "normal" individuals. He suggests that the longer specimens may be males or may represent a distinct species. In view of the association of the two types the present writer is inclined to the view that the variations are attributable to age and sex.

Distribution.—Lowellville (Poverty Run) member, locality 12. Lower Mercer limestone member, locality 20.

HEALDIA LONGULA Cooper
Plate 134, fig. 10

Healdia formosa WARTHIN (not Harlton), 1930, Oklahoma Geol. Survey, Bull. 53, p. 77, pl. 6, figs. 13a, b; Wewoka formation, Oklahoma.
—— CORYELL and SAMPLE, 1932, Am. Midland Naturalist, vol. 13, p. 270, pl. 26, fig. 7; East Mountain shale, Texas.
Healdia longula COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 84, pl. 12, figs. 22–24; Seville zone, Illinois.

Measurements.—Two single valves: length, 0.61 mm.; height, 0.32 mm.

Remarks.—The small fragment illustrated

shows the characteristically narrow, rounded posterior with divergent spines very near the margin. Subsequent to photography, two complete single valves were found in the sample from locality 1. All other material is fragmental.

Distribution.—Lower Mercer limestone member, localities 1, 12 and 20.

HEALDIA sp.
Plate 134, fig. 14

Healdia nucleolata COOPER (not Knight), 1946, Illinois Geol. Survey, Bull. 70, p. 84, pl. 12, figs. 42–45; Ferdinand to Summum zones, Illinois.

Description.—Carapace small, ovate, dorsal margin arched; anterodorsal slope straight; ventral margin slightly convex; anterior evenly rounded; posterior rounded, lower and smaller than anterior; overlap narrow; remnants of a slightly flaring marginal band are preserved on the anteroventral border; posterior shoulder marked by a strong ridge which curves forward dorsally; only the ventral spine is preserved.

Measurements.—Figured specimen: length, 0.41 mm.; height, 0.23 mm.; width, 0.15 mm.

Remarks.—*Healdia nucleolata* Cooper is much larger than *H. nucleolata* Knight and differs from it in its anterior angulation and its strong sharp ridge. The material agrees with Knight's in size but in other respects is close to Cooper's form.

Distribution.—Lower Mercer limestone, localities 14 and 20.

Family HOLLINELLIDAE Swartz, 1936
Genus HOLLINELLA Coryell, 1928
HOLLINELLA DENTATA Coryell
Plate 134, fig. 21

Hollinella dentata CORYELL, 1928, Jour. Paleontology, vol. 2, p. 379, pl. 51, fig. 1; Wewoka formation, Oklahoma.
—— COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 90, pl. 13, figs. 32–38; Fulda to Jamestown zones, Illinois.

Remarks.—Although all of the specimens are incomplete they are assigned to this species with some confidence. The figured individual has a long, straight hinge and if the cardinal areas were restored the general outline of the carapace would fall within the prescribed limits. The anterior node is large and bulbous; the posterior node small, low and defined by the slightly depressed area which surrounds it. Ventral and posterior portions of the shell are full and rounded. Only remnants of a frill are preserved. The figured specimen shows an incomplete length of 0.76 mm. and a height of 0.51 mm.

Distribution.—Lower Mercer limestone member, locality 1. Rare.

Family KIRKBYIDAE Ulrich and Bassler, 1913
Genus AMPHISSITES Girty, 1910
AMPHISSITES CENTRONOTUS (Ulrich and Bassler)
Plate 134, fig. 15

Kirkbya centronota ULRICH and BASSLER, 1906, U. S. Nat. Mus. Proc., vol. 30, p. 159, pl. 11, figs. 16, 17; Cottonwood shale, Kansas.
Amphissites centronotus COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 98, pl. 15, figs. 19–22; Seville to Woodbury zones, Illinois.

Measurements.—Eight typical individuals' average: length, 0.45 mm.; height, 0.25 mm.

Remarks.—This species is described from nearly every ostracode collection from the Lower Pennsylvanian into the Permian. All of the specimens found in the Pottsville formation in Ohio are smaller than average. The shells are very thin and easily broken. It is possible that all are immature or perhaps conditions in this region were unfavorable for this species. Reasonably good specimens are abundant at the localities listed below. Internal molds, tentatively assigned to this species, were found also in the lower Mercer limestone member at localities 12 and 15.

Distribution.—Lowellville (Poverty Run) member, locality 12. Lower Mercer limestone member, localities 1, 2, 12, 13, 18 and 23.

AMPHISSITES cf. A. CONGRUENS Cooper
Plate 134, fig. 16

Amphissites congruens COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 99, pl. 15, fig. 43; LaSalle zone, Illinois.

Measurements.—Figured specimen: length, 0.82 mm.; height, 0.66 mm.

Remarks.—Crushing has made this specimen appear higher than *A. congruens* Cooper from the Missouri Series which it most closely resembles in lobation. Present ma-

terial is too poor to attempt closer identification.

Distribution.—Lowellville (Poverty Run) member, locality 12.

AMPHISSITES RUGOSUS Girty
Plate 134, figs. 17, 18

Amphissites rugosus GIRTY, 1910, Ann. New York Acad. Sci., vol. 20, p. 236; Fayetteville shale, Oklahoma.
—— ROUNDY, 1926, U. S. Geol. Survey, Prof. Paper 146, p. 7, pl. 1, figs. 1a–c; Barnett shale, Oklahoma.
—— COOPER, 1941, Illinois Geol. Survey, Report of Investigation 77, p. 49, pl. 9, fig. 1; Kinkaid formation, Illinois.

Measurements.—Figured specimen: length, 0.86 mm.; height, 0.41 mm.

Distribution.—Lowellville (Poverty Run) member, locality 12. Lower Mercer limestone member, localities 1 and 3. Abundant.

Genus ECTODEMITES Cooper, 1941
ECTODEMITES HARLTONI Cooper
Plate 134, fig. 19

Amphissites sp. HARLTON, 1933, Jour. Paleontology, vol. 7, p. 23, pl. 6, fig. 6; Johns Valley shale, Oklahoma.
Ectodemites harltoni COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 102, pl. 14, fig. 44; Fulda and Seville zones, Illinois.

Measurements.—Three individuals have the following demensions:

Length	Height
0.84 mm.	0.51 mm.
0.77 mm.	0.45 mm.
0.66 mm.	0.35 mm.

Remarks.—This species is limited to the Poverty Run member in our collections, but it is abundant in those samples in which it occurs.

Distribution.—Lowellville (Poverty Run) member, locality 12.

Genus KIRKBYA Jones, 1859
KIRKBYA KELLETTAE Harlton
Plate 134, fig. 22

Kirkbya kellettae HARLTON, 1929, Texas Univ. Bull. 2901, p. 152, pl. 2, figs. 2a–e; Canyon Series, Texas.
—— COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 105, pl. 16, figs. 38, 42; Fulda to Bogota zones, Illinois.

Remarks.—The only specimen of this form in our collection is the posterior half of a right valve. It exhibits the straight hinge, obtuse cardinal angle, slightly convex ventral margin, wide flange, reticulate surface and ridge-like nodes diagnostic of this species.

Distribution.—Lowellville (Poverty Run) member, locality 12.

Genus KIRKBYELLA Coryell and Booth, 1933
KIRKBYELLA cf. K. GUTKEI Croneis and Bristol
Plate 134, fig. 23

Kirkbyella gutkei CRONEIS and BRISTOL, 1930, Denison Univ. Sci. Lab. Bull., vol. 34, p. 84, pl. 4, figs. 14, 15; Menard formation, Illinois.
—— COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 106, pl. 17, fig. 9; Fulda zone, Illinois.

Measurements.—Figured specimen: length, 0.58 mm.; height, 0.33 mm.

Remarks.—Only four single valves of this form were found and in every instance the cardinal angles were broken as the shell material is thin and delicate. However, the general shape of the shell, the sulcus, the pattern of the reticulations and the posteroventral spine, all are closely similar to *K. gutkei* Croneis and Bristol from the Menard formation of Illinois, to *K. unicornis* Coryell and Malkin from the Hamilton formation of Ontario, and to *K. quadrata* Croneis and Gutke from the Renault formation of Illinois. A study of specimens from all of these earlier formations would be necessary to determine the relationship betweeen these species and the individuals found in the Pennsylvanian rocks of Illinois and Ohio.

Distribution.—Lowellville (Poverty Run) member, locality 12. Lower Mercer limestone member, locality 20.

Genus POLYTYLITES Cooper, 1941
POLYTYLITES TRILOBUS (Croneis and Gale)
Plate 134, fig. 20

Amphissites trilobus CRONEIS and GALE, 1938, Denison Univ. Sci. Lab. Bull., vol. 33, p. 271, pl. 5, fig. 5; Golconda formation, Illinois.
Polytylites trilobus COOPER, 1941, Illinois Geol. Survey, Rept. Investigation 77, p. 54, pl. 11, fig. 5; Golconda formation, Illinois.

Measurements.—Figured specimen: length, 0.92 mm.; height, 0.52 mm.

Remarks.—This species was found only in the Poverty Run member and is not abundant.

Distribution.—Lowellville (Poverty Run) member, locality 12.

Family KLOEDENELLIDAE Ulrich and Bassler, 1932

Genus JONESINA Ulrich and Bassler, 1908

JONESINA ARCUATA (Bean)

Plate 135, figs. 4–8

Cypris arcuata BEAN, 1836, Ann. Mag. Nat. Hist., vol. 9, wood-cut figure 5.

Jonesina arcuata (Bean) ULRICH and BASSLER, 1908, U. S. Nat. Mus. Proc., vol. 35, p. 324, pl. 44, figs. 17–19.

—— BRADFIELD, 1936, Bull. Am. Paleontology, vol. 22, p. 38, pl. 2, figs. 6, 7; Dornick Hills formation, Oklahoma.

Measurements.—The specimens figured on Plate 135 have the following dimensions:

Fig.	Length	Height
4	0.41 mm.	0.25 mm.
5	0.46 mm.	0.30 mm.
6	0.61 mm.	0.30 mm.
7	0.76 mm.	0.46 mm.
8	0.76 mm.	0.38 mm.

Remarks.—The young moults associated with the mature individuals may be recognized by their small size and small posterior.

Distribution.—Lower Mercer limestone member, localities 7, 12, 13 and 14.

JONESINA BIFORMIS Bradfield

Plate 135, figs. 2, 3

Jonesina biformis BRADFIELD, 1935, Bull. Am. Paleontology, vol. 22, p. 40, pl. 2, figs. 9a, b; Deese group, Oklahoma.

—— COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 112, pl. 18, figs. 20, 21; Seville zone, Illinois.

Measurements.—Figured specimen: length, 0.62 mm.; height, 0.43 mm.

Distribution.—Lowellville (Poverty Run) member, locality 12. Lower Mercer limestone member, localities 12, 13, 16 and 20.

Genus SANSABELLA Roundy, 1926

SANSABELLA STEWARTAE Marple, n. sp.

Plate 135, figs. 9–18

Description.—Carapace small, subovate; dorsal margin straight; ventral margin convex; ends rounded; anterior extremity low, posterior extremity high, resulting in a pronounced forward swing; hinge channelled, terminated at each end by a notch; sulcus shallow and nearly parallel to the anterior margin. Each valve carries a row

---

EXPLANATION OF PLATE 134

All magnifications ×40.

FIGS. *1–3*—*Fabalicypris wileyensis* Cooper. *1*, lateral view; upper Mercer limestone member, locality 6; *2*, dorsal view; *3*, ventral view; both from lower Mercer limestone member, locality 20. (p. 932)

4–6—*Cavellinella casei* Bradfield. *4*, lateral view; *5*, dorsal view; *6*, lateral view, large single valve, all from lower Mercer limestone member, locality 20. (p. 932)

7—*Sulcella sulcata* Coryell and Sample (?). Lateral view; lower Mercer limestone member, locality 13. (p. 932)

8, 9—*Healdia fabalis* Cooper. *8*, lateral view; lower Mercer limestone member, locality 7; *9*, dorsal view; lower Mercer limestone member, locality 13. (p. 933)

10—*Healdia longula* Cooper. Lateral view of fragment showing posterior spines; lower Mercer limestone member, locality 1. (p. 933)

11—*Healdia glennensis* Harlton. Lateral view, average individual; lower Mercer limestone member, locality 14. (p. 933)

12—*Healdia glennensis* var. Lateral view; Mercer limestone member, locality 20. (p. 933)

13—*Healdia elegans* Warthin. Lateral view, left valve; lower Mercer limestone member, locality 12. (p. 933)

14—*Healdia* sp. Lateral view; lower Mercer limestone member, locality 12. (p. 934)

15—*Amphissites centronotus* (Ulrich and Bassler). Lower Mercer limestone member, locality 18. (p. 934)

16—*Amphissites* cf. *A. congruens* Cooper. Poverty Run member, locality 12. (p. 934)

17, 18—*Amphissites rugosus* Girty. *17*, lateral view; *18*, slightly crushed individual; Poverty Run member, locality 12. (p. 935)

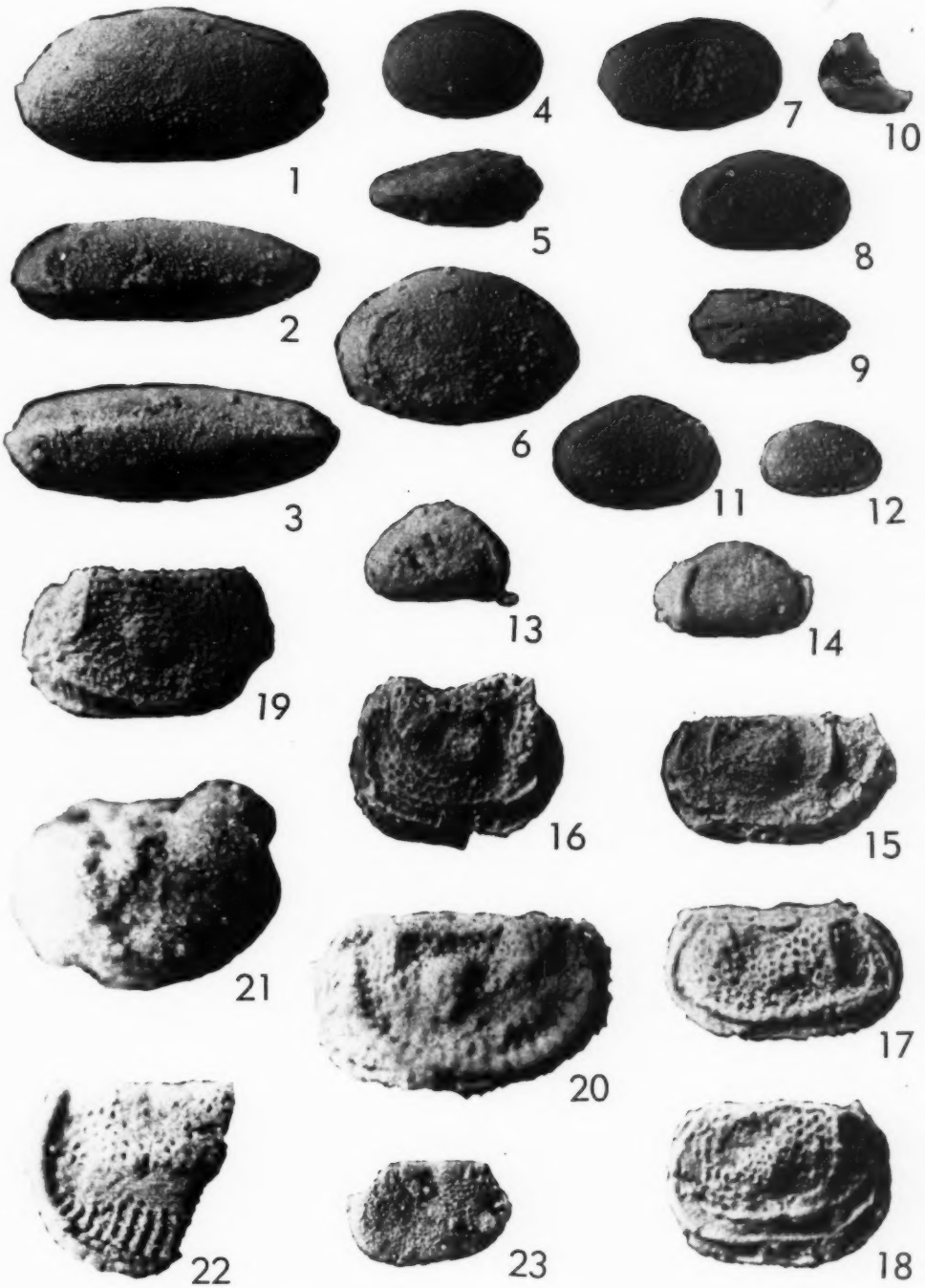
19—*Ectodemites harltoni* Cooper. Poverty Run member, locality 12. (p. 935)

20—*Polytylites trilobus* (Croneis and Gale). Poverty Run member, locality 12. (p. 935)

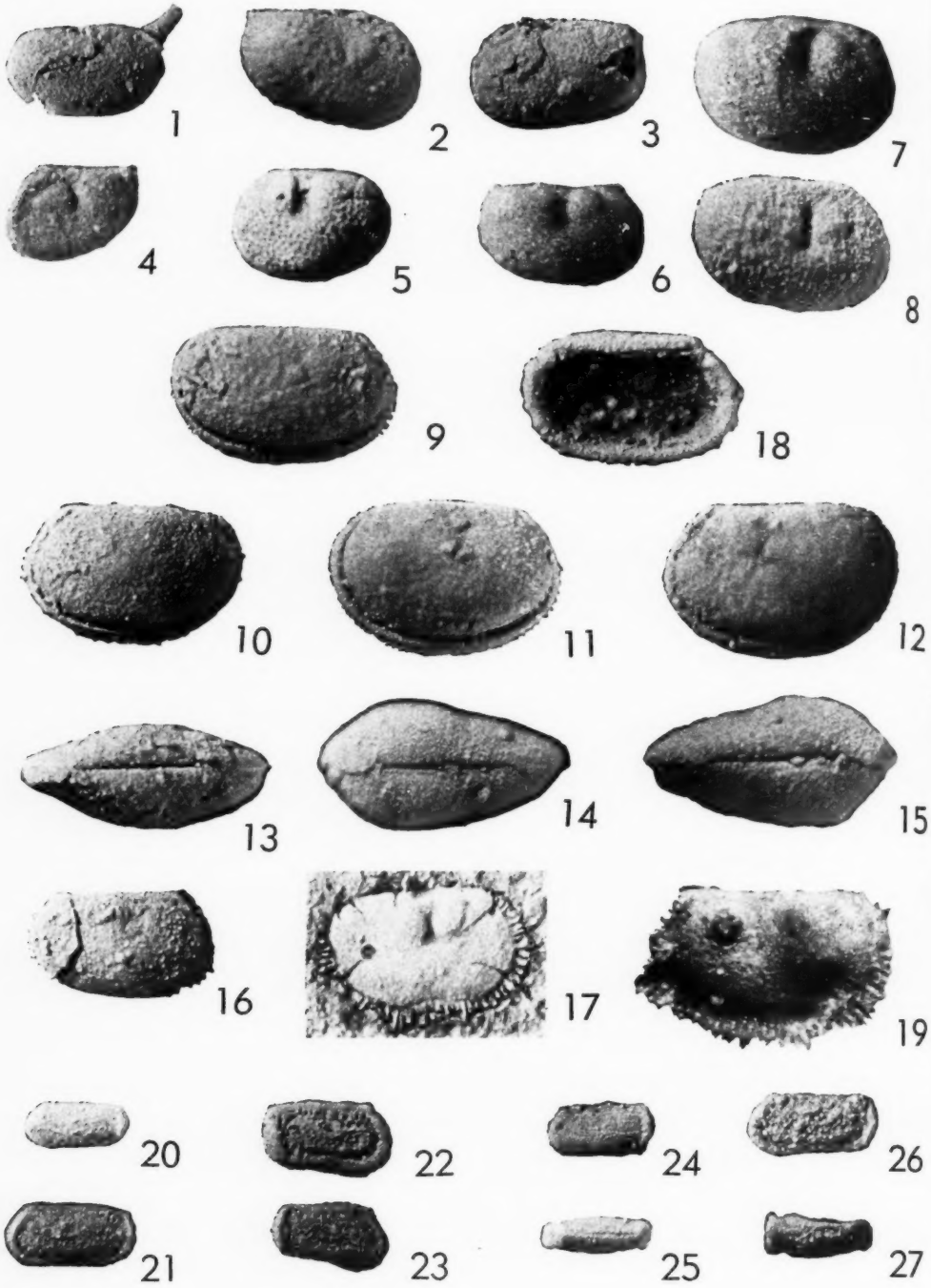
21—*Hollinella dentata* Coryell. Lower Mercer limestone member, locality 1. (p. 934)

22—*Kirkbya kellettae* Harlton. Lateral view of fragment; Poverty Run member, locality 12. (p. 935)

23—*Kirkbyella* cf. *K. gutkei* Croneis and Gale. Poverty Run member, locality 12. (p. 935)



Marple, Pennsylvanian Ostracodes from Ohio



Marple, Pennsylvanian Ostracodes from Ohio

of spines along the line of greatest diameter. Only the bases of these spines are preserved when the shell is freed from the matrix, but when still embedded, they may be seen extending into the shale. The entire surface is covered with fine granulations, the pattern of which follows the free margins.

Two sorts of individuals may be differentiated on the basis of width, with attendant minor differences in lateral outline. This variation is attributable to sexual dimorphism. Those designated males are, on the average, slightly smaller and have smoothly arched shells with the point of greatest thickness just below the sulcus. The females have a wedge-shaped outline in dorsal view with a gibbous posterior.

In the majority of specimens the left valve is larger than the right. However, at five of the seven localities at which specimens were found a number of individuals of both sexes have been recovered in which the right valve is larger.

Measurements.—Average dimensions of males are: length, 0.76 mm.; height, 0.46 mm.; width, 0.35 mm. Average measurements of females are: length, 0.80 mm.; height, 0.52 mm.; width, 0.40 mm.

Remarks.—Associated with the specimens described above are very delicate shells ranging from 0.23 mm. to 0.51 mm. in length. They are sub-elliptical in outline with a straight hinge and rounded ends. The posterior, especially of the smaller individuals, is small. The valves are marked by a deep sulcus extending from a round, sub-central pit and opening broadly toward the hinge. A faint, round node lies anterior to the sulcus. Each valve is bordered along the free margin by a row of spines. The surface is smooth. These are assumed to be immature moults of *S. stewartae*. They show a strong resemblance to *Beyrichiopsis modesta* Ulrich and Bassler from the Lower Mississippian Ridgetop shale of Tennessee, figured, but not described, in Tennessee Divsion of Geology Bulletin 38, pl. 27, fig. 10, 1932. A photograph of the holotype of this form is reproduced in Plate 135, fig. 19 of this report. It has the following dimensions: length, 0.97 mm. (exclusive of spines); height, 0.56 mm.; length of longest spine, 0.2 mm.

B. modesta offers a plausible ancestor for *S. stewartae*. The smallest, and presumably the youngest individuals of the latter species show the anterior node and sulcus more prominently than do the more mature moults. As the convexity of the shell increased with maturity the anterior node became less conspicuous and the sulcus became scarcely more than a shallow pit. The spines appear to be longer on the younger specimens of *S. stewartae* but this

---

EXPLANATION OF PLATE 135

All magnifications ×40.

FIG. *1*—*Microparaparchites elongatus* Cooper. Poverty Run member, locality 12. (p. 938)

2, 3—*Jonesina biformis* Bradfield. *2*, lateral view, right valve; lower Mercer limestone member, locality 20; *3*, left valve; Poverty Run member, locality 12. (p. 936)

4–8—*Jonesina arcuata* (Bean). Ontogenetic series; lower Mercer limestone member, locality 14. (p. 936)

9–18—*Sansabella stewartae* Marple, n. sp. *9*, lateral view, sinistral male; *10*, lateral view, dextral male; *11*, lateral view, sinistral female; *12*, lateral view dextral female; *13*, hinge view, dextral male; *14*, hinge view, sinistral female; *15*, hinge view, dextral female; *16*, *17*, young moults; all from lower Mercer limestone member, locality 15; *18*, interior showing grooved hinge; locality 13. (p. 936)

19—*Beyrichiopsis modesta* Ulrich and Bassler. Left valve of holotype; Ridgetop shale, Tennessee. (p. 937)

20—*Moorites elongatus* (?) (Jones and Kirkby). Lower Mercer limestone member, locality 12. (p. 938)

21—*Moorites spiciferus* (Wilson). Lower Mercer limestone member, locality 12. (p. 938)

22, 23—*Moorites minutus* (Warthin). *22*, lower Mercer limestone member, locality 14; *23*, individual with unusually long posterior; lower Mercer limestone member, locality 13. (p. 938)

24, 25—*Moorites knighti* (?) (Wilson). *24*, lateral view; *25*, hinge view; both from lower Mercer limestone member, locality 15. (p. 938)

26, 27—*Moorites wapanuckensis* (Harlton). *26*, lateral view; *27*, hinge view; both from lower Mercer limestone member, locality 23. (p. 939)

may be in part due to their being broken off the larger shells when they were freed from the matrix. Only the bases of the spines are preserved on the more mature shells. The surface pattern of concentric row of granulations is wanting on the young moults. In short, the beyrichian characteristics are best shown on the young individuals and become less and less conspicuous as the adult stage is approached.

Distribution.—Lower Mercer limestone member, localities 7, 12, 13, 14, 15, 16 and 23.

This species is named in honor of Dr. Grace Anne Stewart, Department of Geology, The Ohio State University.

Family LEPERDITELLIDAE Ulrich and Bassler, 1906

Genus MICROPARAPARCHITES Croneis and Gale, 1938

MICROPARAPARCHITES ELONGATUS Cooper

Plate 135, fig. 1

Microparaparchites elongatus COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 119, pl. 20, figs. 9–11; Liverpool and Sparland zones, Illinois.

Measurements.—Figured specimen: length, 0.56 mm.; height, 0.30 mm.

Distribution.—Lowellville (Poverty Run) member, locality 12. Upper Mercer limestone member, locality 6. Rare.

Family YOUNGIELLIDAE Kellett, 1933

Genus MOORITES Coryell and Billings, 1932

MOORITES ELONGATUS (?) (Jones and Kirkby)

Plate 135, fig. 20

Cytherella (?) *elongata* JONES and KIRKBY, 1886, Ann. and Mag. Nat. Hist., ser. 5, vol. 18, p. 262, pl. 9, figs. 2, 3; Lower limestone, Scotland.

Moorites elongatus (?) COOPER, 1941, Illinois Geol. Survey, Rept. Investigation 77, p. 64, pl. 14, figs. 20, 21; Paint Creek formation, Illinois.

—— COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 122, pl. 21, figs. 7–10; Brereton to Shumway zones, Illinois.

Measurements.—Figured individual: length, 0.35 mm.; height, 0.16 mm.; width, 0.12 mm.

Remarks. It has been suggested by Cooper that these small, unornamented shells are probably immature moults of some other species of *Moorites*. This seems likely.

Distribution.—Lower Mercer limestone member, localities 1, 13 and 14.

MOORITES KNIGHTI (?) (Wilson)

Plate 135, figs. 24, 25

Youngiella knighti (?) WILSON, 1933, Jour Paleontology, vol. 7, p. 417, pl. 50, figs. 2a–c; McAlester shale, Oklahoma.

Moorites knighti (?) COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 122, pl. 21, figs. 5, 6; Seville to Newton zones, Illinois.

Measurements.—Figured specimen: length, 0.38 mm.; height, 0.20 mm.

Remarks.—The delicacy of the shell and absence of ornamentation suggest that this form, too is an immature moult, possibly of *M. wapanuckensis* (Harlton) which it resembles somewhat in outline.

Distribution.—Lower Mercer limestone member, localities 12 and 15.

MOORITES MINUTUS (Warthin)

Plate 135, figs. 22, 23

Glyptopleurina (?) *minuta* WARTHIN, 1930, Oklahoma Geol. Survey, Bull. 53, p. 67, pl. 5, figs. 6a, b; Holdenville formation, Oklahoma.

Moorites minutus CORYELL and BILLINGS, 1932, Am. Midland Naturalist, vol. 13, p. 183, pl. 18, fig. 18; East Mountain shale, Texas.

—— COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 122, pl. 21, figs. 11–17; Seville to Woodbury zones, Illinois.

Measurements.—The specimen shown in Plate 135, fig. 22 has the following dimensions: length, 0.42 mm.; height, 0.20 mm.; width, 0.10 mm.

Remarks.—This is the most common species of *Moorites* in this collection. There is considerable variation in the form-ratio and in the curvature of the ventral margin, as shown in Plate 135, fig. 23.

Distribution.—Lower Mercer limestone member, localities 12, 14, 18, and 20. Upper Mercer limestone member, locality 6.

MOORITES SPICIFERUS (Wilson)

Plate 135, fig. 21

Youngiella spicifera WILSON, 1933, Jour. Paleontology, vol. 7, p. 417, pl. 50, fig. 8a (only); MacAlester shale, Oklahoma.

Moorites spiciferus COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 123, pl. 21, fig. 20, 21; Seville to St. David zones, Illinois.

Measurements.—Figured specimen: length, 0.42 mm.; height, 0.17 mm.; width, 0.15 mm.

Remarks.—This species is not uncommon

in the samples in which it does occur. It may be distinguished by its elongate shape and by the absence of a marginal ridge along the venter.

Distribution.—Lower Mercer limestone member, localities 12, 14, 18, and 20.

MOORITES WAPANUCKENSIS (Harlton)
Plate 135, figs. 26, 27

Youngiella wapanuckensis HARLTON, 1933, Jour. Paleontology, vol. 7, p. 25, pl. 7, figs. 3a, b; Johns Valley shale, Oklahoma.
Moorites wapanuckensis COOPER, 1946, Illinois Geol. Survey, Bull. 70, p. 123, pl. 21, figs. 18, 19; Seville to Collinsville zones, Illinois.

Measurements.—Figured specimen: length, 0.51 mm.; height, 0.25 mm.

Remarks.—This species may be recognized by its prominent marginal ridge and nearly parallel dorsal and ventral margins.

Distribution.—Lower Mercer limestone member, localities 13 and 23.

REFERENCES

AGNEW, ALLEN F., 1942, Bibliographic index of new genera and families of Paleozoic ostracodes since 1934: Jour. Paleontology, vol. 16, pp. 756–763.

BASSLER, R. S., and KELLETT, BETTY, 1934, Bibliographic index of Paleozoic Ostracoda: Geol. Soc. America, Spec. Paper No. 1.

BRADFIELD, H. H., 1935, Pennsylvanian Ostracoda of the Ardmore Basin, Oklahoma: Bull. Am. Paleontology, vol. 22, no. 73.

COOPER, C. L., 1941, Chester ostracodes of Illinois: Illinois Geol. Survey, Rept. of Investigation 77.

——, 1942, Occurrence and stratigraphic distribution of Paleozoic ostracodes: Jour. Paleontology, vol. 16, p. 764.

——, 1946, Pennsylvanian ostracodes of Illinois: Illinois Geol. Survey, Bull. 70.

——, 1947, Microfauna of the upper Kinkaid from Johnson County, Illinois: Jour. Paleontology, vol. 21, pp. 81–92.

CORYELL, H. N., 1926, Some new Pennsylvanian Ostracoda: Jour. Paleontology, vol. 2, pp. 87–94, pl. 11; pp. 377–379.

——, and BILLINGS, GLADYS D., 1932, Pennsylvanian Ostracoda of the Wayland shale of Texas: Am. Midland Naturalist, vol. 13, pp. 179–180.

——, and BOOTH, R. T., 1933, Pennsylvanian Ostracoda: A continuation of the ostracode fauna from the Wayland shale, Graham, Texas: Am. Midland Naturalist, vol. 14, pp. 258–278.

——, and MALKIN, DORIS S., 1936, Some Hamilton ostracodes from Arkona, Ontario: Am. Mus. Novitates, no. 891, pp. 1–20.

——, and SAMPLE, C. H., 1932, Pennsylvanian Ostracoda: A study of the ostracode fauna of the East Mountain shale, Mineral Wells formation, Texas: Am. Midland Naturalist, vol. 13, pp. 245–281.

CRONEIS, CAREY, and BRISTOL, H. N., 1939, New ostracodes from the Menard formation: Denison Univ. Sci. Lab. Bull., vol. 33, pp. 65–102.

——, and GALE, ARTHUR S., JR., 1938, New ostracodes from the Golconda formation: Denison Univ. Sci. Lab. Bull., vol. 33, pp. 251–295.

——, and THURMAN, FRANKLIN A., 1938, New ostracodes from the Kinkaid formation of Illinois: Denison Univ. Sci. Lab. Bull., vol. 33, p. 297 ff.

HARLTON, B. H., 1928, Pennsylvanian ostracodes of Oklahoma and Texas: Jour. Paleontology, vol. 2, pp. 132–141.

——, 1929, Some Upper Mississippian (Fayetteville) and Lower Pennsylvanian (Wapanucka-Morrow) Ostracoda of Oklahoma and Arkansas: Am. Jour. Sci., ser. 5, vol. 18, no. 105, pp. 254–270.

——, 1929, Pennsylvanian Ostracoda from Menard County, Texas: Univ. Texas, Bur. Econ. Geology, Bull. 2901, pp. 139–161, pls. 1, 2, 3, 4.

——, 1933, Micropaleontology of the Pennsylvanian Johns Valley shale of the Ouachita Mountains, Oklahoma, and its relationship to the Mississippian Caney shale: Jour. Paleontology, vol. 7, pp. 3–29.

HARRIS, R. W., and LALICKER, C. G., 1932, New Upper Carboniferous Ostracoda from Oklahoma and Kansas: Am. Midland Naturalist, vol. 13, pp. 396–409.

JOHNSON, W. R., 1936, Ostracoda of the Missouri Series in Nebraska: Nebraska Geol. Survey, Paper 11, pp. 1–52.

KELLETT, BETTY, 1929, The ostracode genus *Hollinella*, expansion of the genus and description of some Carboniferous species: Jour. Paleontology, vol. 3, pp. 196–127.

——, 1933, Ostracodes of the Upper Pennsylvanian and the Lower Permian strata of Kansas, 1: the Aparchitidae, Beyrichiidae, Glytopleuridae, Kloedenellidae, Kirkbyidae, and Youngiellidae: Jour Paleontology, vol. 7, pp. 59–108.

——, 1934, Ostracodes from the Upper Pennsylvanian and Lower Permian strata of Kansas, 2: the genus *Bairdia:* Jour. Paleontology, vol. 8, pp. 120–138.

——, 1935, Ostracodes of the Upper Pennsylvanian and Lower Permian strata of Kansas, 3: Bairdiidae (concl.), Cytherellidae, Cypridinidae, Entomoconchidae, Cytheridae, and Cypridae: Jour. Paleontology, vol. 9, pp. 132–166.

——, 1936, Carboniferous ostracodes: Jour. Paleontology, vol. 10, pp. 769–784.

KNIGHT, J. B., 1928, Some Pennsylvanian ostracodes from the Henrietta formation of eastern Missouri: Jour. Paleontology, vol. 2, pp. 229–267, pp. 318–336.

MOORE, R. C., ET AL., 1944, Correlation of the Pennsylvanian formations of North America: Geol. Soc. America Bull., vol. 55, pp. 657–706, chart.

ROTH, ROBERT, 1929, A revision of the ostracode genus *Kirkbya* and subgenus *Amphissites:* Wagner Free Inst. Sci., Publ. 1, pp. 1–55, pls. 1–3.

ROUNDY, P. V., 1926, Mississippian formations of San Saba County, Texas: U. S. Geol. Survey, Prof. Paper 146, pp. 5–8.

SWARTZ, F. M., 1929, Dimorphism and orientation in ostracodes of the family Kloedenellidae: Jour. Paleontology, vol. 7, p. 231.

——, 1936, Revision of the Primitiidae and Beyrichiidae with new Ostracoda from the Lower Devonian of Pennsylvania: Jour. Paleontology, vol. 10, pp. 541–586.

ULRICH, E. O., and BASSLER, R. S., 1906, New American Paleozoic Ostracoda. Notes and descriptions of Upper Carboniferous genera and species: U. S. Nat. Mus., Proc., vol. 30, pp. 149–164.

——, and ——, 1908, New American Paleozoic Ostracoda. Preliminary revision of the Beyrichidae, with descriptions of new genera: U. S. Nat. Mus., Proc., vol. 35, pp. 277–340.

WANLESS, H. R., 1939, Pennsylvanian correlations in the eastern Interior and Appalachian coal fields: Geol. Soc. America, Spec. Paper 17.

——, 1932, Correlation and extent of Pennsylvanian cyclothems: Bull. Geol. Soc. America, vol. 43, p. 1003.

——, 1944, Symposium of Pennsylvanian problems: Jour. Geology, vol. 55, no. 3, pt. 2.

WARTHIN, A. S., JR., 1930, Micropaleontology of the Wetumka, Wewoka, and Holdenville formations: Oklahoma Geol. Surv., Bull. 53.

WILSON, C. W., JR., 1933, Fauna of the McAlester shale, Pennsylvanian, of Muskogee County, Oklahoma: Jour. Paleontology, vol. 7, pp. 412–422, pl. 50, figs. 1–9.

JOURNAL OF PALEONTOLOGY, VOL. 26, NO. 6, PP. 941–945, 7 TEXT FIGS., NOVEMBER 1952

SOME WILCOX (EOCENE) SPECIES OF THE OSTRACODE GENUS *CYTHERIDEIS*

ALAN H. CHEETHAM
Louisiana State University, Baton Rouge, Louisiana

ABSTRACT—*Cytherideis*, a common ostracode in Tertiary marine sediments, is represented in Wilcox deposits in the Gulf Coastal Plain by at least three species, *C. mayeri* (Howe and Garrett), *C. mcguirti* (Howe and Garrett), and *C. ruggierii* Cheetham, n. sp.

INTRODUCTION

FOSSIL representatives of the genus *Cytherideis* are rather common in Tertiary marine sediments of the Gulf Coastal Plain. Unfortunately, the genus has long been involved in nomenclatural difficulties, and many conflicting opinions about designation of its genotype have been published. Puri (1952, pp. 902–903) reviewed in detail the history of *Cytherideis*, and concluded that *C. botellina* (Jones) is the most likely choice for the genotype.

Puri includes in *Cytherideis* ostracodes having: an elongate carapace rounded at both ends and displaying smooth, perforate, tuberculate, or papillate surfaces; the left valve larger than the right and overlapping it dorsally and ventrally; the line of concrescence departing from the inner margin to form an anterior vestibule; muscle-scars arranged in a vertical row of four preceded by three scars; a hinge consisting of a flange and suprajacent groove in the left valve articulating with the dorsal margin of the right.

Wilcox deposits in the Gulf Coastal Plain yield at least three species of the genus *Cytherideis*. On the basis of external ornamentation, these species fall in two groups; one, characterized by a smooth or very finely pitted carapace, includes *C. mcguirti* (Howe and Garrett) and *C. ruggierii* Cheetham, n. sp.; the other contains but a single species, *C. mayeri* (Howe and Garrett), which possesses a finely reticulate carapace. *C. mcguirti* and *C. mayeri* were questionably referred by their authors to the genus *Bythocypris*. Schmidt (1948, p. 411) placed *C. mayeri* in the genus *Xestoleberis* along with another species, *X. longissima* Schmidt, from the Aquia formation of Maryland, saying that these species "are the only elongate representatives of the genus known." *Cytherideis mayeri*, *C. mcguirti*, and *C. ruggierii* differ from the genotype of *Xestoleberis*, *X. aurantia* Sars, not only in their elongate shape, but also in not possessing the elongate-reniform muscle-scar immediately beneath the anterior cardinal angle (fig. 1).

ACKNOWLEDGEMENTS

This paper is the result of a portion of the research carried out under the tenure of a Humble Oil Company Fellowship at Louisiana State University. I am especially indebted to Dr. Henry V. Howe, director of the School of Geology, L.S.U., both for his

CHART 1.—OCCURRENCE OF *Cytherideis* AT TYPE LOCALITIES OF GULF COAST WILCOX UNITS

State	Texas and Louisiana			Alabama		
Species \ Formation	Marthaville	Pendleton	Sabinetown	Nanafalia	Tuscahoma	Hatchetigbee
C. mayeri (Howe and Garrett)			—	—		—
C. mcguirti (Howe and Garrett)			—			—
C. ruggierii Cheetham, n. sp.				—		

aid and guidance in preparation of this paper, and for the use of his samples and type materials upon which it is based.

TYPES

The repository for all type specimens discussed and figured in this paper is the H. V. Howe Collection, School of Geology, Louisiana State University.

DESCRIPTIONS OF SPECIES

Order OSTRACODA Latreille
Suborder PODOCOPA Sars
Family CYTHERIDAE Baird
Subfamily CYTHERIDEISINAE Puri
Genus CYTHERIDEIS Jones

CYTHERIDEIS RUGGIERII Cheetham, n. sp.
Figs. 2–5

Carapace fragile, in dorsal view elongate-ovate; thickest posterior to the middle; male distinctly thinner than female, lateral borders nearly parallel. In side view elongate-reniform, highest at or just posterior to the middle; left valve slightly larger than right, overlapping it around the entire periphery except on the anterior margin and for a short distance on the dorsal margin posterior to the middle. Dorsal margin gently arched, cardinal angles not prominent. Ventral margin slightly contracted, nearly straight. Anterior end narrowly rounded, dorsally oblique, slightly produced ventrally, compressed, rimmed, and finely denticulate. Posterior end subacute, dorsally oblique, narrower than anterior. Surface rounded and smooth except for numerous, exceedingly fine pits and larger, more widely-spaced normal pore-canals. Interior of valves shallow, smooth, perforated by normal pore-canals. Marginal area broadest at anterior where inner margin departs greatly from line of concrescence, forming a vestibule extending about two-thirds the length of the inner lamella. At posterior end similar, but much smaller vestibule evident. Radial pore-canals straight, simple; about 25 pore-canals in anterior marginal area, 15 to 20 in ventral marginal area, and 10 to 15 in posterior marginal area. Each valve displays a small flange near the middle of the ventral margin; left valve grooved ventrally for reception of flange of right. Hinge-line arcuate following curvature of dorsal margin. Hinge of right valve consists of a long, narrow, dorsally-arched anterior flange separated from the dorsal margin by a faint groove and terminated just posterior to the middle by a long, narrow, straight groove; a horizontal tooth, about four times as long as wide, displaying four or five faint crenulations, is placed at the posterior end of the groove. Corresponding anterior curved groove, postjacent straight flange separated from the dorsal margin by a faint groove, and terminal posterior socket evident in the left valve. Muscle-scars anterior to middle of valves and consisting in each valve of a nearly vertical, anteroventrally inclined row of four; two larger scars, the more anterior being U-shaped, directly anterior to the most dorsal scar of the subvertical row; a seventh scar anterior and slightly ventral to the most ventral scar of the subvertical row.

Dimensions of holotype no. 2325, a male right valve: length, 0.68 mm.; height, 0.27 mm. Paratype no. 2326, a female left valve: length, 0.64 mm.; height, 0.29 mm. Paratype no. 2327, a complete male carapace: length, 0.67 mm.; thickness, 0.27 mm. Paratype no. 2328, a complete female carapace: length, 0.65 mm.; thickness, 0.30 mm.

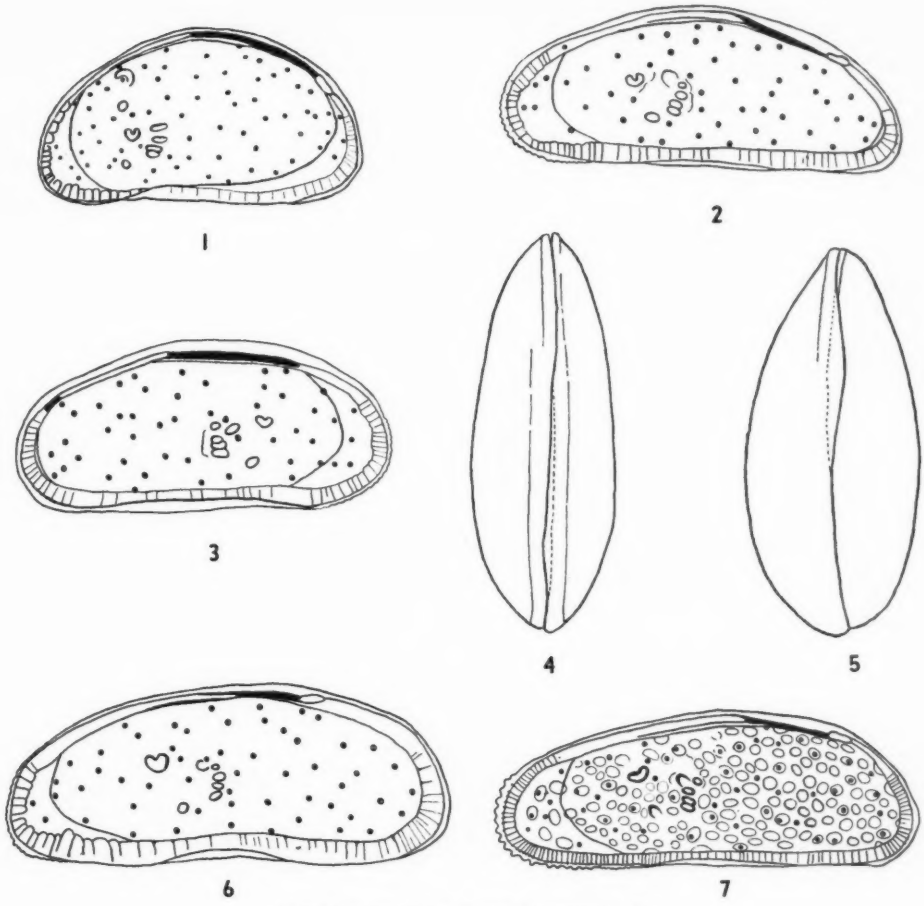
In general appearance, *C. ruggierii* is similar to *C. mcguirti*, but differs from it in having the posterior end more narrowly rounded than the anterior and in having the greatest height closer to the middle. In addition, the fine pitting and small posterior vestibule characteristic of *C. ruggierii* are not evident in *C. mcguirti;* the posterior end is neither laterally compressed nor rimmed as it is in *C. mcguirti.*

This species is named in honor of Giuliano Ruggieri, ostracode researcher at the University of Bologna, Italy. At Nanafalia Landing, Tombigbee River, Alabama, *C. ruggierii* is common in Cooke's (1926, p. 259) Bed 3, from which the type specimens were obtained, and rare in his Beds 1 and 2. It has not been found at other Wilcox localities in the Gulf Coastal Plain.

CYTHERIDEIS MCGUIRTI (Howe and Garrett)
Fig. 6

Bythocypris? mcguirti HOWE and GARRETT, 1934, Louisiana Dept. Conservation, Geol. Bull. no. 4, p. 28, pl. 1, figs. 6, 7.

Carapace fragile, in dorsal view elongate-ovate; thickest posterior to the middle,



EXPLANATION OF TEXT-FIGURES *1–7*

All figs. ×80, and all specimens except *4* and *5* immersed in glycerine and viewed from interior by transmitted light.

FIG. *1*—*Xestoleberis aurantia* Sars, right valve, hypotype no. 2324, Recent, Dogs Bay, Ireland.

2–5—*Cytherideis ruggierii* Cheetham, n. sp. *2*, male right valve, holotype no. 2325; *3*, female right valve, paratype no. 2326; *4*, ventral outline in reflected light, complete male carapace, paratype no. 2327; *5*, dorsal outline in reflected light, complete female carapace, paratype no. 2328. (p. 942)

6—*Cytherideis mcguirti* (Howe and Garrett), male (?) right valve, hypotype no. 2329. (p. 942)

7—*Cytherideis mayeri* (Howe and Garrett), male right valve, hypotype no. 2330. (p. 944)

lateral borders nearly parallel. In side view elongate-reniform, highest at posterior one-third. Dorsal margin gently arched; ventral margin markedly contracted at middle. Anterior end narrowly rounded, dorsally oblique, slightly produced ventrally, compressed, rimmed, finely denticulate, and narrower than posterior. Posterior end subacute, dorsally oblique, produced ventrally, perceptibly compressed, and faintly rimmed and denticulate. Surface rounded and smooth, displaying widely-spaced normal pore-canals. Interior of valves shallow, smooth, perforated by normal pore-canals. Marginal area broadest at anterior end where inner margin departs greatly from line of concrescence, forming a vestibule extending about two-thirds the length of the inner lamella. Radial pore-canals essentially straight and simple; over 20 pore-canals in anterior marginal area, about 20 showing tendency to bifurcate dorsally in

ventral marginal area, and about 20 in posterior marginal area. Valves display a small flange near the middle of the ventral margin; left valve grooved ventrally for reception of flange of right. Hinge-line gently curved following dorsal margin. Hinge of right valve consists of a poorly delimited, long, narrow, curved anterior flange separated from the dorsal margin by a faint groove and followed by a short, narrow, straight groove at the posterior end of which is a horizontal tooth, about three times as long as wide, and showing a few very faint crenulations. Muscle-scars anterior to middle of valve; posterior element consists of a subvertical row of four, very slightly anteroventrally inclined, of which the most dorsal is minute; two scars anterodorsal to the subvertical row, the more anterior being U-shaped; one scar anteroventral to the subvertical row.

Dimensions of hypotype no. 2329, a male (?) right valve: length, 0.75 mm.; height, 0.29 mm.

This species, described by Howe and Garrett from Sabinetown, Texas, and referred by them to *Bythocypris?*, clearly should be placed in the genus *Cytherideis*. The characters of muscle-scars and hinge and the lack of surface-sculpture show it to be closely related to *C. ruggierii*, although it differs from it in having the anterior end more narrowly rounded than the posterior, and in that sexual dimorphism has not been noted. *C. mcguirti* is here redescribed and refigured in order to demonstrate internal characters not previously illustrated in the literature.

C. mcguirti occurs rarely at Sabinetown, Texas, and at Hatchetigbee, Alabama. The hypotype is from the latter locality. This species has not been reported from other Gulf Coast Wilcox units.

CYTHERIDEIS MAYERI (Howe and Garrett)
Fig. 7

Bythocypris? mayeri HOWE and GARRETT, 1934, Louisiana Dept. Conservation, Geol. Bull. no. 4, p. 29, pl. 1, figs. 8–10.

Xestoleberis mayeri (Howe and Garrett), SCHMIDT, 1948, Jour. Paleontology, vol. 22, p. 410, pl. 63, fig. 10; text-fig. 2a.

Carapace fragile, in dorsal view elongate-ovate, thickest posterior to middle; lateral borders nearly parallel. In side view elongate-reniform, highest at posterior one-third. Dorsal margin gently arched, cardinal angles not prominent; ventral margin very slightly contracted, nearly straight. Anterior end narrowly rounded, dorsally oblique, almost imperceptibly produced ventrally, compressed, rimmed, and strongly, although finely denticulate. Posterior end subacute, dorsally oblique, faintly rimmed, and broader than anterior. Surface finely reticulate and pierced by widely-spaced normal pore-canals; a narrow trench trends anteroventrally from the dorsal margin to the muscle-scar area where it bifurcates and disappears. Interior of valves shallow, smooth, perforated by normal pore-canals. Marginal area broadest at anterior end where inner margin departs greatly from line of concrescence forming a vestibule extending about four-fifths the length of the inner lamella. Radial pore-canals straight, simple; nearly 50 porecanals in anterior marginal area, about 35 in ventral marginal area, and about 25 in posterior marginal area. Both valves have a flange at the middle of the ventral margin, that of the right fitting into a groove in the left. Hinge-line arcuate following curvature of dorsal margin. Hinge of right valve consists of a long, narrow, dorsally-arched anterior flange separated from the dorsal margin by a shallow groove and followed by a short, narrow, nearly straight groove terminated posteriorly by a nearly horizontal tooth about four times as long as wide and showing very faint crenulations. Muscle-scars arranged in a subvertical, anteroventrally inclined row of four; two scars, the more anterior U-shaped, anterodorsal to the subvertical row; and a single scar anteroventral to the subvertical row.

Dimensions of hypotype no. 2330, a male right valve: length, 0.72 mm.; height, 0.26 mm.

This species, although it differs from *C. ruggierii* and *C. mcguirti* in possessing reticulate sculpture, seems to be congeneric with them because of great similarities in shape of carapace, structure of hinge, character of marginal area, and arrangement of muscle-scars. It most nearly approaches *C. mcguirti* in shape of carapace,

for the anterior end is narrower than the posterior.

C. mayeri was described from Sabinetown, Texas, where it occurs rarely. At Nanafalia Landing, Alabama, it occurs rarely in Cooke's Beds 2 and 3. The hypotype is from Bed 2. Schmidt (1948, p. 411) reported this species from the Aquia formation of Maryland.

REFERENCES

COOKE, C. W., in ADAMS, G. I., STEPHENSON, L. W., and COOKE, C. W., 1926, Geology of Alabama: Geol. Survey Alabama, Spec. Rept. no. 14, 313 pp., 97 pls., 4 figs.

HOWE, H. V., and GARRETT, J. B., JR., 1934, Louisiana Sabine Eocene Ostracoda: Louisiana State Dept. Conservation, Geol. Bull. no. 4, 64 pp., 4 pls.

PURI, H. S., 1952, Ostracode genus *Cytheridea* and its allies: Jour. Paleontology, vol. 26, pp. 902–914, pls. 130–131, 14 text-figs., 1 table, 1 chart.

SCHMIDT, RUTH A. M., 1948, Ostracoda from the Upper Cretaceous and lower Eocene of Maryland, Delaware, and Virginia: Jour. Paleontology, vol. 22, pp. 389–431, pls. 61–64, 2 text-figs., 3 tables.

JOURNAL OF PALEONTOLOGY, VOL. 26, NO. 6, PP. 946–952, 20 TEXT FIGS., NOVEMBER 1952

ENDOTHYROID FORAMINIFERA FROM THE GREENBRIER SERIES (MISSISSIPPIAN) OF NORTHERN WEST VIRGINIA

JOHN L. WRAY
West Virginia University, Morgantown, West Virginia

ABSTRACT—Thin-section examination reveals the presence of endothyroid foraminifers in varying abundance throughout the limestone beds of the Greenbrier series. Representatives of the genera *Endothyra* and *Plectogyra* are described and illustrated from two horizons in northern West Virginia. Distinct species of these genera are found to occur at definite stratigraphic horizons. A similarity of shell morphology is noted in a comparison of endothyroids from Mississippian rocks of the Mississippi Valley region with forms from northern West Virginia. There is, however, a marked difference in stratigraphic range.

INTRODUCTION

Scope of paper.—This paper presents a discussion of endothyroid foraminifers from the lower Upper Mississippian rocks of Monongalia County, West Virginia. The Greenbrier series in this area consists of three major lithologic members. The basal member is a cross-bedded, quartz-arenaceous limestone. Interbedded red and green shales and sandstones make up the middle member. The upper member is composed of massive, fossiliferous limestone. Recent stratigraphic work by the writer (Wray, 1951) indicates that the Greenbrier series in northern West Virginia is exclusively Chesterian in age.

The fauna in question was collected primarily from two horizons at separate localities along W. Va. Highway 7 about 5 to 6 miles southeast of Morgantown. At Greer, the lower horizon occurs approximately 10 feet below the top of the basal member of the Greenbrier series. In an abandoned quarry one mile north of Sturgisson, the upper horizon is present 57 feet below the top of the Greenbrier series. This discussion is concerned principally with assessing the stratigraphic significance of the endothyroid foraminifers encountered in the Greenbrier series in the study area. The term endothyroid is used to designate foraminifers that belong to the genus *Endothyra* or to closely related genera. Random sampling has revealed that microfossils, including several genera of Foraminifera and Ostracoda, occur in varying amounts throughout the limestone beds of the Greenbrier series in this area as well as in other parts of West Virginia and southwestern Pennsylvania. Two genera of endothyroid foraminifers are recognized, but due to insufficient data, no attempt has been made to distinguish existing species or to describe new species.

Previous work.—The genus *Endothyra* was originally described by Thomas Brown in 1843. Several interpretations have resulted from this description because it is decidedly inadequate. Since that time many forms have been included in the genus that only remotely resemble the original figure and description (Scott, Zeller, and Zeller, 1947). The principal point of difference appears to be the inclusion of planispirally coiled forms as well as forms that are not coiled in a single plane. Endothyroids are involute and therefore the manner of coiling cannot be readily determined externally. Thus, sections reveal the nature of coiling. Zeller (1950, p. 3) believes the planispiral forms closely resemble the original description by Brown. Therefore, endothyroids possessing this type of coiling are included in the genus *Endothyra*. Zeller (1950, p. 3) includes the endothyroid forms that are not planispiral in a new genus named *Plectogyra*. The writer finds the designation of these two genera most advantageous and herein recognizes the presence of both *Endothyra* and *Plectogyra*.

The occurrence of microfossils in the Greenbrier series has been noted in geologic literature on several occasions, but appar-

ently no concentrated study of the Foraminifera contained in it has been undertaken.

Methods of study.—The foraminifers of the Greenbrier series occur, for the most part, in a hard and compact limestone, and the most practical manner of study is to prepare thin sections of the rock and examine these microscopically in transmitted light. A thin section of the limestone shows the enclosed tests of foraminifers cut in various directions. A sufficient number of thin sections were made in order to show most of the possible orientations of the endothyroid forms. It is difficult, if not impossible, to infer the exact external appearance of the endothyroids from thin sections. Several attempts were made to extract complete specimens from the limestone. On one occasion a few endothyroids were obtained by crushing the rock but the external features of these forms were poorly preserved. The descriptions of the endothyroid foraminifers included in this paper were obtained entirely from thin-section examination.

Acknowledgments.—Acknowledgment is made to the Department of Geology, West Virginia University, for generously providing the assistance and laboratory facilities necessary to conduct this research.

FAUNAL DISCUSSION

Differentiation of Endothyra *and* Plectogyra.—The important factor in differentiating *Plectogyra* from *Endothyra* is the nature of coiling. The genus *Endothyra* includes tests that are coiled planispirally. The genus *Plectogyra* as described by Zeller (1950, p. 3) contains shells in which "coiling is particularly distinctive in being logarithmic in character, but the spiral is twisted along an axis so that a three-dimensional spiral is produced." With the exception of the manner of coiling, the two genera are similar in many respects. It is especially noteworthy that there is a considerable variation in the angles of rotation of the three-dimensional spiral forms. There exists a complete gradation of forms from absolutely planispiral to those with very large angles of rotation. If the angle of rotation of the spiral is zero, then the form is *Endothyra*. A form with angles of rotation other than zero should, by definition, be considered *Plectogyra*. However, very slight angles of rotation would not be noted in a cross section, and the form would be incorrectly included in the genus *Endothyra*.

Apparent differences, with respect to type and morphology of shells, were noted in a comparison of the endothyroid populations found in the upper and lower members of the Greenbrier series.

Endothyroid foraminifers that are definitely planispiral were observed only in the upper member. The test of *Endothyra* is chambered, discoidal, and involute. It is slightly umbilicate on both sides. There are usually four volutions. The maximum width of the test is about one-half the maximum diameter. The diameter of forms studied varies from 208 to 416 microns. The chambers are convex outward and the sutures are depressed. The number of chambers in the last whorl of specimens examined varies from 9 to 13. There is no apparent relation between the number of chambers and the diameter of the specimen. A tunnel extends back through the entire coil to the proloculum. The test is unornamented. The aperture is simple, low and at the base of the apertural face. The height of the tunnel is greater than the aperture height. There is no secondary deposit on the floor of the chambers. The wall is calcareous.

The question arises that possibly the specimens herein described are not *Endothyra* but *Millerella* (Thompson, 1942, p. 404), the primitive fusulinid genus. According to Zeller (1950, p. 5), "the primitive fusulinids, which the endothyroids most closely resemble, do not possess a true aperture at any growth stage." The specimens described by the writer as *Endothyra* definitely possess an aperture.

A comparison of specimens of *Endothyra* as described by Zeller (1950) from the Mississippi Valley region with forms from northern West Virginia reveal a marked similarity of morphology. The most easily recognized difference is the greater size of the majority of Mid-Continent *Endothyra*. In addition, many of the *Endothyra* illustrated by Zeller (1950) show a hook or node projecting from the floor of the last chamber just behind the aperture. This feature was not observed by

the writer in any of the *Endothyra* from northern West Virginia.

Endothyroids that are coiled so as to form a three-dimensional spiral were observed in both the upper and lower members of the Greenbrier series in northern West Virginia. A test of *Plectogyra* is chambered, discoidal, and involute to slightly evolute. It is asymmetrical, being umbilicate on only one side, or unequally umbilicate on opposite sides. The test is unornamented. The nature of the coiling is irregular and complex and a three-dimensional figure is produced by a twisting of the spiral. The axis of coiling is not fixed, but revolves. The angles of rotation vary considerably with different specimens. Three to five volutions are present. There are usually 6 to 8 chambers in the last whorl. The diameter of forms examined varies from 176 to 672 microns. The maximum width of the test is about one-half the maximum diameter. The chambers are convex outward and the sutures are depressed. In some forms the last chambers are greatly expanded. A tunnel extends through the entire coil. The aperture is simple and low. The aperture height is less than the height of the tunnel. The walls are calcareous. Some *Plectogyra* show thick secondary deposits of calcium carbonate, often in the form of nodes, on the floors of the chambers.

A comparison of *Plectogyra* from the lower member of Greenbrier series with specimens from the upper reveals the following contrasts, and it appears very possible to discriminate between these members on the basis of the *Plectogyra* populations.

1. *Plectogyra* from the lower member show a greater diversity of size than specimens from the upper.

2. The outer walls of larger *Plectogyra* from the lower member are proportionally thicker than the outer walls of larger forms from the upper.

3. Most *Plectogyra* from the upper member possess secondary deposits within the shell. This feature is not observed in specimens from the lower.

4. The septa of many large *Plectogyra* from the lower member are rather stout and appear to be shortened. This feature is not noted in forms from the upper.

Undoubtedly some of these differences will be sufficient to justify species designation of *Plectogyra*. The stratigraphic order of appearance of these variations suggests evolutionary development, but the influence of the environment of deposition may be important.

A general comparison of morphologies of Mississippian *Plectogyra* as illustrated by Zeller (1950) from the Mississippi Valley area with specimens from northern West Virginia indicates great similarity. In specimens from northern West Virginia, the development of calcareous secondary deposits within the shell at the higher stratigraphic level, as noted previously, corre-

---

EXPLANATION OF TEXT-FIGS. *1–19*

All figs. ×57.

FIGS. *1, 3, 5*—*Plectogyra* sp. Horizontal-axial sections; lower member, Greenbrier series, Greer, W. Va.

2—*Endothyra?* sp. Cross-section showing large proloculum; lower member, Greenbrier series, Greer, W. Va.

4—*Plectogyra* sp. Horizontal-axial section; lower member, Greenbrier series, Greer, W. Va.

6, 8, 9—*Plectogyra* sp. Horizontal-axial sections showing secondary deposits; upper member, Greenbrier series, Sturgisson, W. Va.

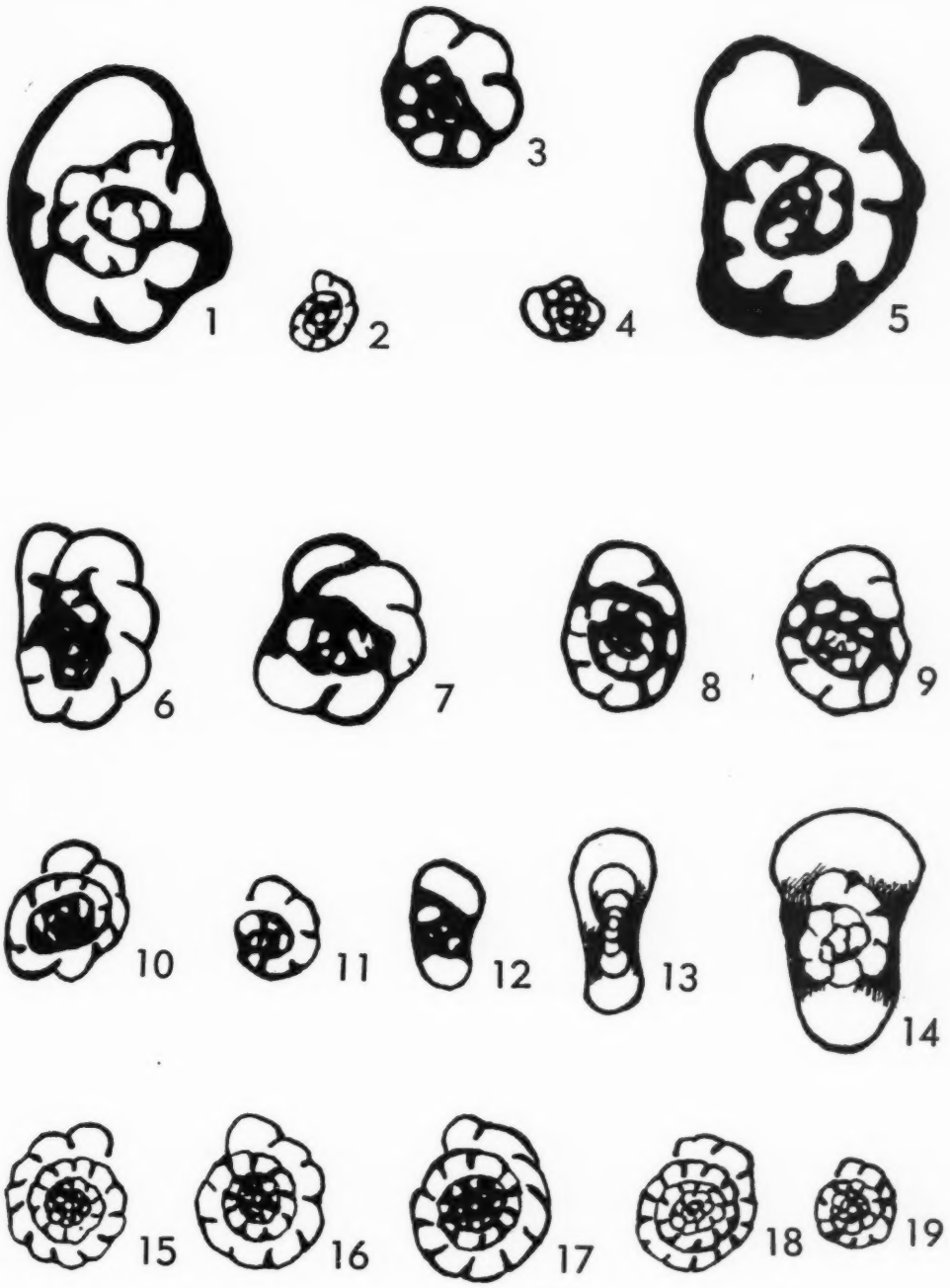
7—*Plectogyra* sp. Oblique section; upper member, Greenbrier series, Sturgisson, W. Va.

10, 11—*Plectogyra* sp. Horizontal-axial sections showing aperture; upper member, Greenbrier series, Sturgisson, W. Va.

12, 14—*Plectogyra* sp. Vertical-axial sections; upper member, Greenbrier series, Sturgisson, W. Va.

13—*Endothyra?* sp. Axial section; upper member, Greenbrier series, Sturgisson, W. Va.

15–19—*Endothyra* sp. Cross-sections; aperture shown in *15, 18, 19;* upper member, Greenbrier series, Sturgisson, W. Va.



TEXT-FIGS. 1–19

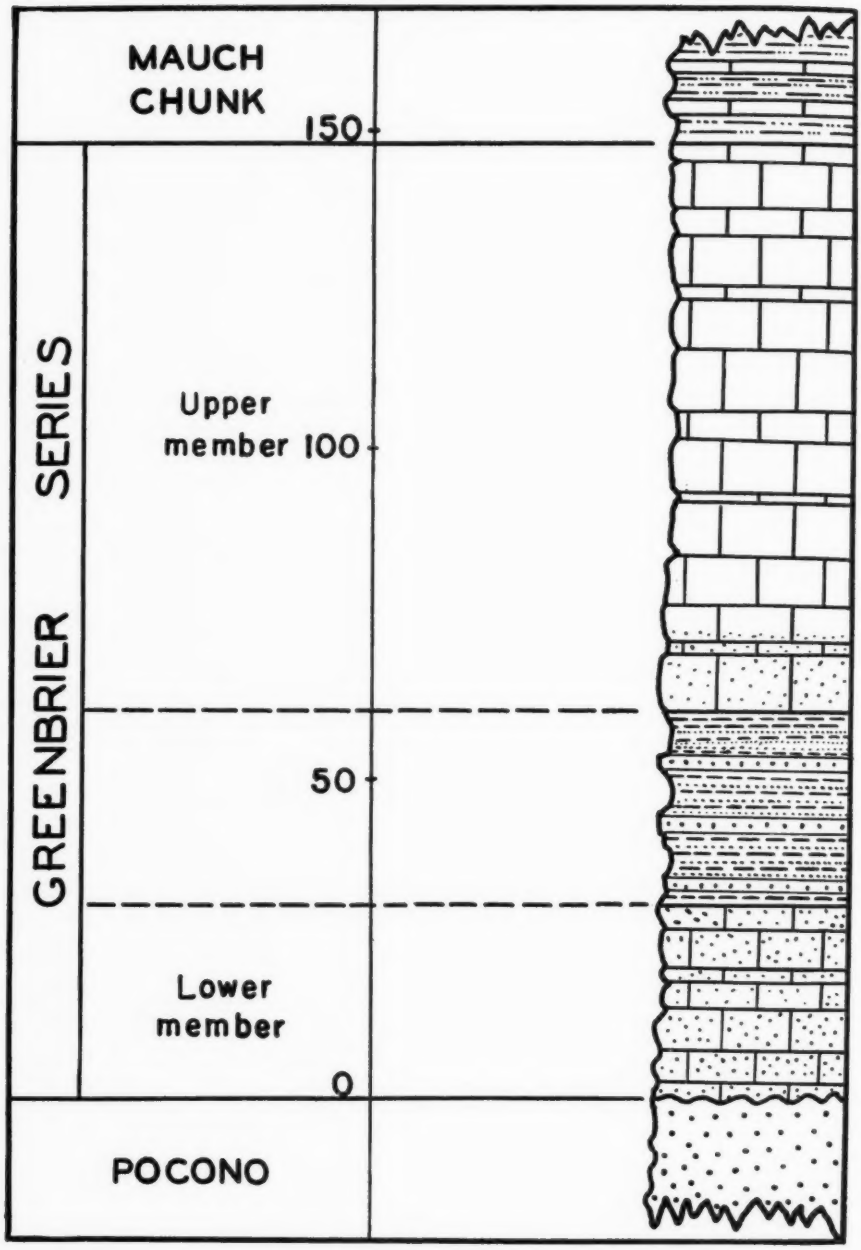


FIG. *20*—Columnar section of Mississippian rocks of Monongalia County, West Virginia.

sponds with the phylogenetic trend of *Plectogyra* in the Mid-Continent region.

Endothyroids of questionable affiliation.—A group of small endothyroid foraminifers occurs in the lower member of the Greenbrier series. The small size of these forms apparently is not due to unfavorable environmental conditions, because the largest endothyroid forms examined occur in this member. These specimens, for the most part, appear planispiral and resemble *Endothyra*. They differ from those previously described in being smaller and in having a large proloculum (fig. 2). This suggests the possibility that these are megalospheric forms of *Endothyra*, whereas the forms discussed earlier are microspheric. If this is true, the following discrepancy exists. That is, microspheric forms were not found in the lower member but are common in the upper, whereas megalospheric *Endothyra* are found only in the lower member. If present in the upper member, they are not recognized as such. Generally, the megalospheric form of a species is the most common, but in some of the smaller foraminifers the two stages are essentially similar and it is difficult to distingush microspheric from megalospheric forms.

Zeller (1950, p. 22) has suggested that *Endothyra* descended from *Plectogyra*. Perhaps the small planispiral endothyroids that occur in the lower member are ancestral forms of *Endothyra* and actually complete a phylogenetic sequence between *Plectogyra* and *Endothyra*. The exact determination of these small endothyroids is not attempted at this time.

Stratigraphic ranges.—*Plectogyra* occurs in both the basal and upper members of the Greenbrier series in northern West Virginia. The morphology of the shells in the two members, however, differs to the extent that the respective members of the Greenbrier might be differentiated. Although *Plectogyra* ranges throughout the Mississippian system in the Mississippi Valley region (Zeller, 1950), the upper Chesterian forms are characterized by the development of secondary deposits. This feature is also noted in forms from the upper member of the Greenbrier series which is considered to be upper Chesterian in the area investigated.

In addition to other faunal evidence, the principal basis for correlating the Greenbrier series in northern West Virginia with Chesterian rocks of the Mississippi Valley is the occurrence of the pelecypod *Sulcatopinna missouriensis* (Swallow) in the upper member. This pelecypod is a guide fossil for the Elvira group of the Chesterian series in the type region. Endothyroid forms that could be positively identified as *Endothyra* were found only in the upper member of the Greenbrier series. Mississippian *Endothyra* are restricted to Meramecian rocks in the Mississippi Valley (Zeller, 1950, p. 19). In the study area, both *S. missouriensis* (Swallow) and *Endothyra* are present in the upper member of the Greenbrier series. *Millerella* (Zeller, 1950, p. 19) occurs in upper Chesterian rocks of the Mid-Continent area, but was not found by the writer in the strata investigated. *Millerella* may be present at a higher stratigraphic level in northern West Virginia, because it is found in the Mississippi Valley in rocks younger than those containing *Endothyra*. It is possible that the range of *S. missouriensis* (Swallow) in northern West Virginia extends into rocks considerably below those which are approximate time equivalents of the Elvira group, but undoubtedly *Endothyra* ranges far into Chesterian rocks in the same area. Whatever the case, planispiral endothyroids and *S. missouriensis* (Swallow) occur in the same rocks in the northern Appalachian region.

CONCLUSIONS

In summary the writer concludes:

1. Endothyroid foraminifers are present in varying abundance throughout the limestone beds of the Greenbrier series.
2. Distinct types of the endothyroids occur at definite stratigraphic horizons, although many of these types may be facies forms.
3. The recognition of different types of endothyroids from surface as well as subsurface samples should have value in determining local stratigraphic correlations.
4. Additional data are required before

species determination can be attempted.

5. A similarity of shell morphology is noted in a comparison of Mississippian endothyroids of the Mississippi Valley region with forms from northern West Virginia.
6. There is a marked difference in the stratigraphic ranges of the planispiral endothyroids from Meramecian rocks of the type region as compared with similar forms from northern West Virginia. Therefore, long-range correlations seem impractical until more is known of the phylogeny of the endothyroids from the Appalachian region.

REFERENCES

BROWN, T., 1843, The elements of fossil conchology: Houlston & Stoneman, London, Edinburgh.

SCOTT, H. W., ZELLER, E. J., and ZELLER, D. E., 1947, The genus *Endothyra:* Jour. Paleontology, vol. 21, pp. 557–562, pls. 1–2.

THOMPSON, M. L., 1942, New genera of Pennsylvanian fusulinids: Am. Jour. Sci., vol. 240, pp. 403–420.

WRAY, JOHN L., 1951, Chesterian stratigraphy of northern West Virginia and southwestern Pennsylvania (Abstract): Amer. Assoc. Petrol. Geol., 1950 Program of Annual Meetings, p. 30.

ZELLER, E. J., 1950, Stratigraphic significance of Mississippian endothyroid Foraminifera: Univ. Kansas Paleon. Contr., Protozoa, Article 4, pp. 1–23, pls. 1–6.

JOURNAL OF PALEONTOLOGY, VOL. 26, NO. 6, PP. 953–992, NOVEMBER 1952

BIBLIOGRAPHY AND INDEX TO NEW GENERA, SPECIES, AND VARIETIES OF FORAMINIFERA FOR THE YEAR 1951

HANS E. THALMANN
School of Mineral Sciences, Stanford University, Stanford, California

ABSTRACT—The following bibliography lists, for the year 1951, 387 papers dealing partly or exclusively with Foraminifera or their use in stratigraphy. Fifty-one titles are added for previous years.

The index to new genera, species, and varieties (subspecies) of Foraminifera for the year records as new: one order, 3 suborders, 2 families (exclusive of the other 11 listed by Hofker in Lit. 154 of this bibliography), 2 subfamilies, 43 genera, 1 subgenus, 366 species, 72 varieties, 7 nomina nova, 4 nomina nuda, 18 homonyms (of which 13 have already been renamed), and 188 forms to which the nomenclatura aperta was applied. Supplementary listings for years prior to 1951 include as new: one subfamily, 10 genera, 133 species, 33 varieties, 10 homonyms and one form with nomenclatura aperta.

Acknowledgments.—The compiler is very much indebted to the following persons for valuable assistance given him in his task: Clifford C. Church (Palo Alto), S. Boltovskoy (Buenos Aires), Heinrich Hiltermann (Hannover), Merle C. Israelsky (Pasadena), K. Jacob (Calcutta), Siemon W. Muller (Stanford), Vladimir Pokorny (Prague), Jacques Sigal (Paris), and to all the authors who generously furnished reprints of their publications.

Cordial thanks are due to Marianne U. Thalmann who ably assisted the compiler in typing, checking and collating the card-index and the manuscript.

BIBLIOGRAPHY FOR 1951

1. ABRARD, RENE, Developpements tératologiques chez des Orbitoides crétacés: Acad. Sci. Paris, Comptes-rendus, vol. 232, pp. 1369–1370.
2. ABRARD, RENE, Individus tératologiques de Nummulites d'Aquitaine: Soc. géol. France, Comptes-rendus, pp. 95–96, 7 text figs.
3. ABRARD, RENE, Observations géologiques aux Clayes-sous-Bois (Seine-et-Oise): Museum Nation. Hist. Nat. Paris, Bull., ser. 2, vol. 23, pp. 566–568.
4. ACCORDI, BRUNO, Su di un caso di "convergenza" fra Foraminiferi e briozoi fossili: Riv. Ital. Paleont. e Stratigr., vol. 57, pp. 21–22, text figs. 1, 2.
5. ADKINS, W. S., and LOZO, FRANK E., Stratigraphy of the Woodbine and Eagle Ford, Waco area, Texas: Fondren Science Series No. 4, South. Methodist Univ. Press, Dallas, pp. 101–161, 26 figs., 6 pls.
6. ALBERTI, ANTONIO, Osservazioni sul Miocene medio e superiore nell'Appennino Centrale (Basini umbro-marchigiano e abruzzese): Serv. Geol. Italia (anno 1950), Boll., vol. 72, fasc. 1, pp. 103–109, pls. 1, 2.
7. ALBERTI, ANTONIO, Sulla campagne geologica Maggio-Giugno 1950, Foglio 139 (L'Aquila): Ibid., Boll., vol. 72, pp. 227–228.
8. ALLEMANN, FRANZ, BLASER, R., and NANNY, P., Neuere Untersuchungen in der Vorarlberger Flyschzone: Eclog. Geol. Helvetiae, vol. 44, no. 1, pp. 159–168, 7 text figs., 1 table.
9. ALTINLI, I. E., The geology of the western portion of Filyos River: Univ. Istanbul, Revue Fac. Sci., ser. B., vol. 16, pt. 2, pp. 153–188 (non vidi).
10. ALVAREZ, MANUEL, JR., Geological significance of the distribution of the Mexican oil fields: Third World Petrol. Congress, Proc. Sect. I, pp. 73–85, 12 figs.
11. ANDERSEN, HAROLD V., An addenda to *Arenoparrella* and *Arenoparrella mexicana* (Kornfeld): Cushman Found. Foram. Research, Contr., vol. 2, pt. 3, pp. 96–97, pl. 11, fig. 4.
12. ANDERSEN, HAROLD V., Two new genera of Foraminifera from Recent deposits in Louisiana: Jour. Paleontology, vol. 25, pp. 31–34, 8 text figs.
13. ANONYMOUS, Limestone of the Ebishima, northern end of Tsushima (in Japanese): Geol. Soc. Japan, Jour., vol. 72, no. 673, pp. 457–458, 6 text figs.
14. ANONYMOUS, (A.D.), Obituary Notices: Federico Sacco: Geol. Soc. London, Quart. Jour., vol. 106, pt. 3, Proc., pp. lv–lvi.
ARAI, JUZO, see WATANABE, K., and others.
15. ARNAUD, G., Sur les acquisitions nouvelles de la géologie en Afrique Occidentale Française depuis 1940: Intern. Geol. Congr., 18th Session, Great Britain 1948, Rept., part 14, pp. 56–60.
16. ARNOLD, ZACH M., Occurrence of *Gromia oviformis* Dujardin in California (Testacea): The Wasman Jour. of Biol., vol. 9, pp. 351–353. See also: KLEINPELL, R. M.
17. ASANO, KIYOSHI, Recent and Tertiary *Cyclammina* from Japan and adjacent re-

gions: Tohoku Univ., Sendai, Inst. Geol. and Paleont., Short Papers, No. 3, pp. 13–24, pls. 3, 4, 1 table.
18. ASANO, KIYOSHI, and STACH, LEO W., Illustrated catalogue of Japanese Tertiary smaller Foraminifera. Part 6: Miliolidae: Tokyo, Japan (Hosokawa Printing Co.), 31 January 1951, 20 pp., 139 figs.
19. ASANO, KIYOSHI, and STACH, LEO W., Illustrated catalogue of Japanese Tertiary smaller Foraminifera: Part 7: Cassidulinidae, 7 pp., 45 figs., Part 8: Polymorphinidae, 14 pp., 72 figs.: Ibid., 2 April 1951, 21 pp., 117 figs.
20. ASANO, KIYOSHI, and STACH, LEO W., Illustrated catalogue of Japanese Tertiary smaller Foraminifera. Part 9: Ophthalmidiidae, Part 10: Lituolidae, Part 11: Trochamminidae, Part 12: Chilostomellidae, Part 13: Anomaliidae: Ibid., 19 pp., 110 figs.
21. ASANO, KIYOSHI, and STACH, LEO W., Illustrated catalogue of Japanese Tertiary smaller Foraminifera. Part 14: Rotaliidae, Ibid., 21 pp., 155 text figs.
22. ASANO, KIYOSHI, and STACH, LEO W., Illustrated catalogue of Japanese Tertiary smaller Foraminifera. Part 15: Lagenidae, Ibid., 39 pp., 104 figs.
23. AVNIMELECH, M. (Micropaleontological News): Israel: The Micropaleontologist, vol. 5, no. 1, p. 15.
24. AVNIMELECH, M. (Micropaleontological News): Israel: Ibid., vol. 5, no. 4, p. 23.
25. AVNIMELECH, M., Contribution to the knowledge of the Quarternary oscillations of the shore-line in Palestine: Reprint, 13 pp.
26. BAKER, W. H. V., A simple technique for extracting microfossils: The Micropaleontologist, vol. 5, no. 4, pp. 39–40.
27. BANDY, ORVILLE L., Upper Cretaceous Foraminifera from the Carlsbad area, San Diego County, California: Jour. Paleontology, vol. 25, pp. 488–513, pls. 72–75, 2 text figs., 2 tables.
28. BANDY, ORVILLE L., Bathymetric distribution of some shallow-water Foraminifera in the Gulf of Mexico (Abstract): Geol. Soc. America, Bull., vol. 62, p. 1521.
29. BANDY, ORVILLE L., and BURNSIDE, R. J., The genus *Siphogenerina* Schlumberger: Cushman Found. For. Res. Contr., vol. 2, pp. 13–15.
30. BANDY, ORVILLE L., and MERRIAM, RICHARD H., Test wall microstructure as a basis for separating *Nonion* and *Elphidium* (Abstract): Geol. Soc. America Bull., vol. 62, p. 1521.
31. BARTENSTEIN, HELMUT, Faziesbeobachtungen an der Grenze vom brackischem zu marinem Valendis des Rehburger Sattels: Naturhist. Ges. Hannover, 101. Jahresber., pp. 34–42, 3 figs.
32. BARTENSTEIN, HELMUT, Stand der Tertiärforschung im süddeutschen Raum. Eine Rückschau auf die 65. Austauschsitzung für Mikropaläontologie und Stratigraphie in München, am 8. und 9. Mai 1951: Erdöl und Kohle, 4 Jahrg., pp. 679–683, 4 text figs.
33. BARTENSTEIN, HELMUT, and BRAND, ERICH, Mikropaläontologische Untersuchungen zur Stratigraphie des nordwestdeutschen Valendis: Senckenberg. Naturf. Ges., Abhandl. no. 485, Festschrift Rudolf Richter, pp. 239–336, pls. 1–25, 3 text figs.
34. BARTUSEK, VACLAV, Mineralogicko-geologicka bibliografia ČSR za rok 1950 (Bibliographie minéralogique et géolgique de la République Tchécoslovaque, Année 1950): Praha 1951, Priv. Vydav., 124 pp.
35. BATES, ROBERT L., Claude Ervin Needham (1894–1950) (Memorial): Amer. Assoc. Petrol. Geologists, Bull., vol. 35, pp. 120–131, 1 portrait.
BATTISTINI, R., see: GUILCHER, A., et al.
36. BECKMANN, HEINZ., Hilfsmittel zum Schleifen von Mikrofossilien: Paläont. Zeitschr., vol. 24, pp. 91–94, 2 text figs.
37. BELLEN, R. C. VAN (Micropaleontological News): Near East: The Micropaleontologist, vol. 5, no. 1, pp. 16–17.
38. BERMUDEZ, PEDRO J., *Heminwayina*, un genero nuevo de los Foraminíferos rotaliformes y sus especies: Soc. Ciencias Nat. La Salle, Caracas, Mem., tomo 11, no. 30, pp. 325–329, 9 text figs.
BLASER, RUDOLF, see ALLEMANN, F., and others.
39. BLUMENTHAL, MORITZ M., Geologische Skizze der türkischen Öl- und Asphaltregion am mittleren und oberen Tigris: Schweiz. Petrol., Geol. u. Ing., Bull., vol. 18, pp. 5–24, 5 text figs.
40. BLUMENTHAL, MORITZ M., Recherches géologiques dans le Taurus occidental dans l'arrière-pays d'Alanya: Maden Tetkik ve Arama Enstit. Yayinlar., series D., no. 5, Ankara, 134 pp., 22 figs., 22 photos, map.
41. BOLLI, HANS, Notes on the direction of coiling of rotaloid Foraminifera: Cushman Found. Foram. Res., Contr., vol. 2, pt. 4, pp. 139–143, 1 text fig.
42. BOLLI, HANS, The genus *Globotruncana* in Trinidad, B. W. I. Notes on occurrence, nomenclature and relationship between species: Jour. Paleontology, vol. 25, pp. 187–199, pls. 34, 35, 1 text fig., 2 tables.
43. BONARELLI, GUIDO, La Maiella (Appennino centrale): Servizio Geol. Italia, Boll., vol. 71 (anni 1947–1949), pp. 59–76.
BONNARD, E. G., see GUBLER, Y., and others.
44. BOURCART, JACQUES and MARIE, P., Sur la nature du "Rébord Continental" à l'ouest de la Manche: Acad. Sci. Paris, Comptes-rendus, vol. 232, pp. 2346–2348.
BRAND, ERICH, see BARTENSTEIN H., and BRAND, E.
45. BRILL, KENNETH G., JR., Permo-Pennsylvanian zeugogeosyncline of Colorado and northern New Mexico (Abstract): Geol. Soc. America, Bull., vol. 62, p. 1425.
46. BRONNIMANN, P., A model of the internal structure of *Discocyclina* s.s.: Jour. Paleontology, vol. 25, pp. 208–211, 1 text fig.
47. BRONNIMANN, P., *Globigerinita naparimaen-*

sis n. gen., n. sp., from the Miocene of of Trinidad, B. W. I.: Cushman Found. For. Res., Contr., vol. 2, pp. 16–18, 14 text figs.

48. BRONNIMANN, P., *Guppyella, Alveovalvulina,* and *Discamminoides,* new genera of arenaceous Foraminifera from the Miocene of Trinidad, B. W. I.: Ibid., vol. 2, pt. 3, Oct. 1951, pp. 97–105, 12 text figs., pl. 11, figs. 4–7.
49. BRONNIMANN, P., Internal structure of *Cyclammina cancellata:* Jour. Paleontology, vol. 25, pp. 756–761, 13 text figs.
50. BRONNIMANN, P. (Micropaleontological News): West Indies: The Micropaleontologist, vol. 5, no. 1, pp. 3–5.
51. BRONNIMANN, P., The genus *Orbulina* d'Orbigny in the Oligo-Miocene of Trinidad, B.W.I.: Cushman Found. For. Res., Contr., vol. 2, pt. 4, pp. 131–138, 4 text figs.

51a. BRONNIMANN, P., Die Mundöffnungen bei *Asterigerina carinata* d'Orbigny 1839: Eclog. geol. Helvetiae, vol. 44, No. 2, pp. 469–474, 3 text figs. (No. 370 for the year 1951).

51b. BRONNIMANN, P., Remarks on the embryonic chambers of upper Eocene Asterocyclinidae of Trinidad, B.W.I.: Ibid., pp. 474–486, 10 text figs. (No. 371 for the year 1951).

52. BROTZEN, FRITZ, Bidrag till de svenska marina kvartaravlagringarnas stratigrafi: Geol. Fören. Förhandl. Stockholm, Bd. 73, H. 1, no. 464, pp. 57–68, 2 figs. (with discussions pp. 143–149).
53. BROTZEN, FRITZ (Micropaleontological News): Scandinavia-Denmark, Norway, Sweden: The Micropaleontologist, vol. 5, no. 2, pp. 12–13.
54. BRUCKNER, WERNER, Lithologische Studien und zyklische Sedimentation in der helvetischen Zone der Schweizeralpe: Geol. Rundschau, vol. 39, no. 1, pp. 196–212, 2 tables.
55. BUSH, JAMES, Rock from straits of Florida: Amer. Assoc. Petroleum Geologists, Bull., vol. 35, ppl 102–107, 3 figs.
56. BUTCHER, W. S., Foraminifera, Coronado Bank and vicinity, California: Univ. Calif., Scripps Instit. Oceanography, ref. 51-21 Submarine Geol. Rept., no. 19, Marine Foram. Labor., Sept. 15, 1951, mimeographed, pp. i–iii, 1–9, 6 text figs.
57. CAMPBELL, CARLYLE B., The Campbell micro-fossil washer: Iowa Acad. Sci., vol. 58, pp. 275–277.

CAMPBELL, CARLYLE B., see HUSSEY, KEITH M., and CAMPBELL, CARLYLE B.

58. CAROZZI, ALBERT, Glauconisation de la biotite dans la Crétacé moyen des chaînes subalpines et du Jura: Cahiers Géologiques de Thoiry, no. 4, Janvier 1951, pp. 33–37, 2 figs.
59. CAROZZI, ALBERT, Rythmes de sédimentation dans le Crétacé hélvetique: Geol. Rundschau, vol. 39, no. 1, pp. 177–195, 4 text figs.
60. CAROZZI, ALBERT, Sédimentation rythmique dans la nappe de Morcles-Aravis (Chaînes subalpines de Haute-Savois, France): Third Internat. Congr. Sedimentol. Groningen-Wageningen, Netherlands, Proc., pp. 81–89, 2 text figs., 1 table.

CAROZZI, ALBERT, see: PAREJAS, E., and CAROZZI, A.

61. CARTER, D. J., Indigenous and exotic Foraminifera in the Coralline Crag of Sutton, Suffolk: Geol. Magazine, vol. 88, pp. 236–248, 4 graphs.
62. CHAPUT, MME. ERNEST, and YALCINLAR, ISMAIL, Un lambeau de calcaires carbonifères au Nord-Ouest d'Istanboul: Acad. Sci. Paris, Comptes-rendus, vol. 232, pp. 994–995.

62a. CHAUVEL, M. J., Microfossiles du Pliocène de Saint-Jean-la-Poterie (Morbihan): 76. Congr. Soc. des Savants, Paris 1951, pp. 159–162 (non vidi).

63. CIRY, RAYMOND, Observations sur le Crétacé de la Navarre espagnole au Nord-Ouest de Pampelune: Acad. Sci. Paris, Comptes-rendus, vol. 233, pp. 72–74.
64. CIRY, RAYMOND, and RAT, PIERRE, Un Foraminifère nouveau du Crétacé supérieur de la Navarre espagnole: Bull. Scient. Bourgogne, vol. 13, 1950–1951, Dijon 1951, pp. 75–86, pl. 2, 2 figs.
65. CITA, M. B., La direzione dell'avvolgimento nell'evoluzione delle Globorotaliidae: Riv. Ital. Paleont. e Stratigr., vol. 57, no. 3, pp. 84–85.
66. CIZANCOURT, M. DE, Grands Foraminifères du Paléocene, de l'Eocène inférieur et de l'Eocène moyen du Venezuela: Soc. Géol. France, Mém., n.s. tome 30, fasc. 1–2, Mem. no. 64, pp. 1–68, pls. 1–6, 19 text figs., 3 tables.
67. CIZANCOURT, M. DE, (Micropaleontological News): France: The Micropaleontologist, vol. 5, no. 3, pp. 5–8.
68. COLOM, GUILLERMO, *Globigerina* "ratio." Su distribucion y complejidad en los mares Terciarios alrededor de la Meseta Castellana: Instit. Biolog. Aplicada Publ., vol. 9, pp. 63–82, 6 pls., 6 text figs.
69. COLOM, GUILLERMO, Micropaleontologia aplicada: Estudio del sondeo profundo de Oliana (provincia de Lerida): Inst. Geol. y Minero de Espana, Bol. vol. 63, Madrid 1951, pp. 1–52, 8 pls. 6 figs., 3 tables.
70. COLOM, GUILLERMO, (Micropaleontological News): Spain: The Micropaleontologist, vol. 5, no. 3, pp. 9–11.
71. COLOM, GUILLERMO, and GAMUNDI, J., Sobre la extension e importancia de las "Moronitas" a lo largo de las formaciones aquitano-burdigalienses del estrecho nort-betico: Inst. "Lucas Mallada" de Investig. Geol., Madrid, Estudios Geol. no. 14, pp. 331–385, pls. 25–36, 8 text figs., tables.
72. CROUCH, ROBERT W., *Nodosarella verneuili* (d'Orbigny) from the Pliocene of the Los Angeles Basin: Cushman Found. For. Res., Contr., vol. 2, pp. 9–10, pl. 2, figs. 2–6.
73. CROUCH, ROBERT W., Significance of temperature upon the Foraminifera from the deep basins off the southern California coast (Abstract): Geol. Soc. America, vol. 62, p. 1521.

74. CROWLEY, A. J., Possible Lower Cretaceous uplifting of Black Hills, Wyoming and South Dakota: Amer. Assoc. Petroleum Geologists, Bull., vol. 35, pp. 83–90, 1 fig., 3 tables.
75. CUSHMAN, JOSEPH A., Paleocene Foraminifera of the Gulf Coastal region of the United States and adjacent areas; descriptions and illustrations of smaller Foraminifera from the Gulf Coastal region, Cuba, Central America, Haiti, and Trinidad: U. S. Dept. Interior, Geol. Survey, Prof. Paper no. 232, 75 pp., 24 pls. 4 tables.
76. CUSHMAN, JOSEPH A., and STAINFORTH, R. M., Tertiary Foraminifera of coastal Ecuador: Part 1, Eocene: Jour. Paleontology, vol. 25, pp. 129–164, pls. 25–28, 4 text figs.
77. CUVILLIER, J., Corrélations stratigraphiques par microfaciès en Aquitaine occidentale (with discussions by F. R. S. Henson, A. N. Thomas, M. Reichel and J. Cuvillier, pp. 447–448): Third World Petrol. Congress, Proc., Sect. 1, pp. 446–448.
78. CUVILLIER, J., and SACAL, V., Corrélations stratigraphiques par microfaciès en Aquitaine occidentale: Leiden (E. J. Brill) 1951, 23 pp., 90 pls., 1 text fig. (map).
79. CUVILLIER, J., DUPOUY-CAMET, J., and SACAL, V., L'anticlinal de Roquefort-des-Landes et les pointements crétacés de Créon-Saint-Julien: Soc. Géol. France, Bull. (6) vol. 1, pp. 553–584, 7 text figs.
CUVILLIER, J., see: GUBLER, Y., and others.
80. DACI, ATIFE, Etude paléontologique du Nummulitique entre Kugukcekmece et Catalca 2: Istanbul Univ. Fen Fakult. Mecmuesi.; Fac. Sci. Univ. Istanbul, Revue, série B., tome 16, fasc. 3, 1951, pp. 89–112 and pp. 207–246, 5 pls.
81. DAM, A. TEN (Micropaleontological News): North Africa: The Micropaleontologist, vol. 5, no. 1, pp. 14–15.
82. DAVIS, A. G., *Howchinia bradyana* (Howchin) and its distribution in the Lower Carboniferous of England: Geologists' Assoc., Proc., vol. 62, pp. 248–253, pls. 10, 11.
DENHAM, R. L., see STEIG, M. H., and others.
83. DERVILLE, HENRI, Le calcaire massif à *Prod. sublaevis* de la région d'Avesnes: Soc. géol. France, Bull., series 6, vol. 1, pp. 453–467, pl. 16.
84. DESIO, A., Cenno riassuntivo sulla costituzione geologica della Libia: Intern. Geol. Congr., 18th Session, Great Britain 1948, Rept. part 14, pp. 47–53.
85. DESIO, A., Guido Bonarelli: Riv. Ital. di Pal. e Strat., vol. 57, no. 2, pp. 62–63.
86. DESIO, A., Carl Renz: Ibid., vol. 57, no. 2, p. 63.
87. DESIO, A., Alfredo Silvestri: Ibid., vol. 57, no. 1, pp. 29–30.
88. DESIO, A., Alfredo Silvestri, 1867–1950: The Micropaleontologist, vol. 5, no. 4, pp. 41–42, 1 photo.
89. DIETZ, C., and HILTERMANN, H., Neuere geologische Beobachtungen am Lindener Kreideeinbruch in Hannover: Naturhist. Ges. Hannover, vol. 99–101. Jahrbuch für die Jahre 1947–1948 bis 1949–1950, pp. 43–51, 2 figs.
90. DONZE, PIERRE, Existence du faciès purbéckien sur le Causse Mejean dans la région de La Parade (Lozère): Acad. Sci. Paris, Comptes-rendus, vol. 233, pp. 1044–1045.
91. DONZE, PIERRE, Les formations de la limite Jurassique-Crétacé dans les massifs subalpines des Banges et de la Chartreuse: Ibid., vol. 232, no. 9, pp. 862–864.
92. DONZE, PIERRE, Presence de calcaires lacustres dans le Virgulien de la Montagne-de-l'Epine (Jura méridional): Soc. Géol. France, Comptes rendus, pp. 296–298.
93. DROOGER, C. W., Foraminifera from the Tertiary of Anguilla, St. Martin and Tintamarre (Leeward Islands, West Indies): Kon. Akad. Wetensch. Amsterdam., Proc., ser. B., vol. 54, no. 1, pp. 54–65, 5 text figs.
94. DROOGER, C. W., Notes on some representatives of *Miogypsinella:* Ibid., ser. B., vol. 54, no. 4, pp. 357–365, 7 figs.
95. DROOGER, C. W., Upper Cretaceous Foraminifera of the Midden-Curaçao beds near Hato, Curaçao (N.W.I.): Ibid., ser. B., vol. 54, no. 1, pp. 66–72, 11 text figs.
96. DROOGER, C. W., and VOUTE, C., Sur la présence d'Inocérames dans un niveau post-Mastrichtien près d'Ain-Fakroun (Algérie): Soc. géol. France, Bull., ser. 6, vol. 1, pp. 313–317.
97. DUBOURDIEU, G., and SIGAL, J., Albien, Vraconnien et Cénomanien inférieur de l'Ouenza (Algerie): Observations nouvelles et subdivision corrigés: Soc. géol. France, Comptes-rendus, pp. 78–80.
98. DUFOUR, J., Facies shift and isochronous correlation: Third World Petrol. Congr., The Hague, 1951, Proc. Sect. 1, Geol. and Geophys., pp. 428–438, 6 figs.
99. DUPLAN, J., Sur l'âge de flysch de la bordure Sud de la chaine calcaire de la Kabylie du Djurdjura (Algerie): Acad. Sci. Paris, Comptes-rendus, vol. 233, no. 1, pp. 70–72.
DUPLAN, L., see FLANDRIN, J., and DUPLAN, L.
DUPUOY-CAMET, JACQUES, see: CUVILLIER, J. and others.
100. DUSENBURY, A. N., JR. (Micropaleontological News): Venezuela: The Micropaleontologist, vol. 5, no. 4, pp. 7–10.
101. EAMES, F. E., A contribution to the study of the Eocene in western Pakistan and western India; D. Discussion of the faunas of certain standard sections, and their bearings on the classification and correlation of the Eocene in western Pakistan and western India: Geol. Soc. London, Quart. Jour., vol. 107, pt. 2, 1951, pp. 173–200, 3 text figs., tables.
102. EAMES, F. E., A contribution to the study of the Eocene in western Pakistan and western India. (With discussions by: P. Evans, W. L. F. Nuttall, L. Fermor and W. L. Grill): Geol. Soc. London, Abstr., Proc., no. 1469, Jan. 11, 1951, pp. 30–34.

103. EDWARDS, EVERETT C., Los Angeles region. (Possible future petroleum provinces of North America): Am. Assoc. Petroleum Geologists, Bull., vol. 35, pp. 241–248, 2 figs.

104. EGERAN, E. N., On the oil fields located in South-Eastern Turkey: Maden tetkik ve Arama Enstitusu, M. T. A., no. 41, pp. 59–64, 5 graphics.

EGERAN, NECDET, see: TASMAN, C., and EGERAN, N.

104a. EJNOR, O. L., Visean stage in Armenia (in Russian): Akad. Nauk SSSR., Doklady, vol. 78, no. 6, pp. 1195–1197 (non vidi).

ELDER, S., see: ION, D. C., and others.

105. ELLENBERGER, F., Le Crétacé supérieur briangonnais au Nord de l'Arc et la nappe des Schistes lustres: Soc. Géol. France, Comptes-rendus, fasc. 1–2, pp. 10–12.

106. ELLIS, BROOKS F., A model of *Triticites:* The Micropaleontologist, vol. 5, no. 3, p. 14, 1 text fig.

107. ELLIS, BROOKS F., A new research center: Ibid., vol. 5, no. 2, p. 24.

108. ELLIS, BROOKS F., and MESSINA, ANGELINA, R., Catalogue of Foraminifera, Supplement for 1951, no. 1: Amer. Mus. Nat. Hist. New York, Spec. Publ., 733 pp., ill.

109. ELLIS, BROOKS F., and MESSINA, ANGELINA R., Catalogue of Foraminifera, Supplement for 1951, no. 2: Ibid., Spec. Publ., 744 pp., ill.

110. ELLIS, BROOKS F., and MESSINA, ANGELINA R., Catalogue of Foraminifera, Supplement for 1951, no. 3: Ibid., Spec. Publ., 657 pp., ill.

111. ELLIS, BROOKS F., and MESSINA, ANGELINA R., Catalogue of Foraminifera, Supplement for 1951, no. 4: Ibid., Spec. Publ., 464 pp., ill.

112. ELLISON, SAMUEL P., JR., Microfossils as environment indicators in marine shales: Jour. Sediment. Petrology, vol. 21, pp. 214–225, figs. 1–7.

113. EMILIANI, CESARE, Notes on thin sectioning of smaller Foraminifera: Jour. Paleontology, vol. 25, pp. 531–532.

114. EMILANI, CESARE, On the species *Homotrema rubrum* (Lamarck): Cushman Found. Foram. Res., Contr., vol. 2, pt. 4, pp. 143–147, pls. 15, 16, 1 text fig., 1 table.

115. ENDO, RIUJI, Bibliography of Japanese paleontology and related sciences, 1941–1950: Paleont. Soc. of Japan, Spec. Paper no. 1, 71 pp.

116. ERK, A. SUAT (Micropaleontological News): Turkey: The Micropaleontologist, vol. 5, no. 2, pp. 21–22.

EVANS, P., see: EAMES, F. E.

117. FACCA, G., Three gas-bearing fields in the Po Valley (North Italy): Third World Petrol. Congr., Proc., Sect. 1, pp. 256–265, 8 figs.

FENAROLI, see: GAFFURINI FENAROLI, P.

FERMOR, LEWIS, see: EAMES, F. E.

118. FEUGUEUR, L., Sur l'Yprésien des bassins français et belge, et l'âge des sables d'Aeltre: Soc. Belge Géol., Paléont. et d'Hydrol., Bull., vol. 60, 1951, fasc. 2, pp. 216–242, 3 pls.

118a. FEUGEUR, LEON, Le Nummulitique de la nappe de Morcles entre Arve et Suisse: Soc. géol. France, Bull., ser. 6, vol. 1, pp. 671–692, 5 text figs. (No. 374 for the year 1951).

119. FLANDRIN, J., and DUPLAN, L., Sur l'âge crétacé du flysch de la bordure méridionale de la chaine du Djurdjura et son prolongement occidental: Acad. Sci. Paris, Comptes-rendus, vol. 233, pp. 425–426.

FOX, S. K., in: NORTHROP, J., and HEEZEN, B. C.

120. FRIZZELL, DON L., Notes on a volume of Terquem's mémoires on Jurassic Foraminifera: The Micropaleontologist, vol. 5, no. 1, pp. 22–23.

121. FULMER, CHARLES V., Foraminifera of the "Sidney" Nortonville, and Kellogg shales (Abstract): Geol. Soc. America, Bull., vol. 62, p. 1522.

122. GAFFURINI FENAROLI, P., L'affioramento pliocenico di Villa d'Alme (Bergamo): Riv. Ital. di Paleont. e Stratigr., vol. 57, no. 2, pp. 49–52, 1 table.

GAMUNDI, J., see: COLOM, G., and GAMUNDI, J.

123. GIANOTTI, A., Sezioni sottili di microfossili, Riv. Ital. Pal. e Strat., vol. 57, no. 3, p. 84.

124. GLAESSNER, M. F., Three foraminiferal zones in the Tertiary of Australia: Geol. Magazine, vol. 88, pp. 273–283, 1 stratig. table.

125. GONZALEZ DE JUANA, CLEMENTE, Introduccion al estudio de la geologia de Venezuela: Venezuela Minist. Min. e. Hidrocarb., Direcc. de Geol., Bol. de Geol., vol. 1, no. 1, pp. 119–139, 11 text figs.

126. GONZALEZ DE JUANA, CLEMENTE, Introduccion al estudio de la geologia de Venezuela. Segunda parte, Capitulo 3: Las formaciones mesozoicas en los Andes venezolanos y en la subcuenca del Lago de Maracaibo: Ibid., Bol. de Geol., vol. 1, no. 2, pp. 195–216, 4 figs., 2 pls.

127. GOODMAN, A. J., White specks in Colorado shale: Am. Assoc. Petroleum Geologists, Bull., vol. 35, pp. 2427–2429, 1 fig.

128. GORTANI, M., Risultati di una spedizione geologica nella Dancalia meridionale e sugli altipiani di Harrar e di Giggiga (1936–1937 and 1937–1938): Internat. Geol. Congress., 18th Session, Great Britain 1948, pp. 193–198, 1 text fig.

GRAY, SHAPLEIGH G., see: STEIG, M. H., and others.

129. GREKOFF, N., and GUBLER, Y., Donées complémentaires sur les terrains tertiaires de la Nouvelle Calédonie: Inst. France Pétrole et Ann. Combust. Liq., Revue, vol. 6, 283–293, 4 figs., 4 pls.

GREKOFF, N., see: LYS, M., and GREKOFF, N.

130. GRILL, R., (Micropaleontological News): Austria: The Micropaleontologist, vol. 5, no. 2, April, pp. 4, 5.

GRILL, W. D., see: EAMES, F. E.

131. GRIMSDALE, T. F., Correlation, age determination, and the Tertiary pelagic Foraminifera (with discussions by H. Hiltermann, M. Lys, W. Riedel, F. Brotzen, C. R. J. Terpstra and T. F. Grimsdale, pp. 474–475): Third World Petrol. Congr., The Hague, Proc., Section 1, pp. 463–472, 1 table.

132. GRIMSDALE, T. F., Appendix 1: Notes on the pelagic Foraminifera in the Blue Marls of Biarritz, France: Ibid., Proc., Section 1, pp. 472–473.

133. GRIMSDALE, T. F., Appendix 2: On a sample of upper Lutetian from Grande Carrière, Lassalle, Landes, France: Ibid., Proc., Sect. 1, p. 473.

134. GRIMSDALE, T. F., Appendix 3: Note on taxonomic procedure for micropaleontologists: Ibid., Proc., Sect. 1, pp. 473–474.

135. GRIMSDALE, T. F., *Hantkeninella* Bronnimann, a synonym of *Hantkenina* Cushman (Foraminifera, Eocene): Ann. Mag. Nat. Hist., series 12, vol. 4, pp. 292–294, pl. 8.

136. GUBLER, Y., CUVILLIER, J., BONNARD, E. G., MAUGIS, P., MICHEL, P., and PEREBASKINE, V., La géologie de l'Aquitaine et ses possibilités pétrolifères: Third World Petrol. Congr., The Hague, Proc., Sect. 1, pp. 296–314, 2 figs., 6 pls.
GUBLER, Y., see: GREKOFF, N., and GUBLER, Y.

137. GUILCHER, A., MARIE, P., and BATTISTINI, R., Un gisement de craie sur l'éstran à Landéda (Finistère): Soc. géol. France, Comptes-rendus, pp. 196–198.

138. HAGER, DORSEY, Practical oil geology (fig. 37 and table 20, Index Foraminifera of the Gulf Coast and geologic section of Texas Gulf Coast prepared by Arnold D. Hoffman): McGraw-Hill Book Co., Inc., New York, sixth ed., second printing, 589 pp., ill.

139. HAGN, HERBERT, Das Alter der Konglomerate des Tratenbachs bei Lenggries (Bayr. Alpen). Ein Beitrag zur Mikropaläontologie der Alpenrandzone: N. Jahrb. f. Min., Geol. u. Pal. Monatshefte Abt. B., 1951, no. 4, pp. 103–118.
HAINES, RICHARD B., see: MCCLELLAN, H. W., and HAINES, R. B.

140. HALBOUTY, MICHEL T., and HARDIN, GEORGE C., JR., Types of hydrocarbon accumulation and geology of South Liberty Salt Dome, Liberty County, Texas: Am. Assoc. Petroleum Geologists, Bull., vol. 35, pp. 1939–1977, 20 text figs.

141. HANZAWA, SHOSHIRO, Fossil Foraminifera from Angaur Island: Inst. Geol. and Paleont., Tohoku Univ., Short Papers no. 3, pp. 109–126, 1 table.

142. HANZAWA, SHOSHIRO, Recent and fossil *Cycloclypeus* from the Ryukyu Islands and their adjacent sea: Ibid., Short Papers, no. 3, pp. 1–12, pls. 1, 2, 10 text figs., 1 table.

143. HANZAWA, SHOSHIRO and HATAI, KOTORA, Japanese papers on ecology and paleoecology for the period 1948–1951: Rept. 11, Comm. Treatise Marine Ecol. and Paleoecol., Nat. Research Council, Washington, Div. Geol. and Georgr., pp. 72–82.
HARDIN, GEORGE C., JR., see: HALBOUTY, M. T., and HARDIN, G. C., JR.

144. HARRIS, R. W., and JOBE, BILLYE IRENE, Microfauna of basal Midway outcrops near Hope, Arkansas: Norman (Oklahoma), The Transcript Press. Distributed through Div. Geol., Arkansas Res. and Develop. Comm., Little Rock, Ark., 85 pp., 14 pls.
HATAI, KOTORA, see: HANZAWA, S., and HATAI, K.
HAYASHI, TADAICHI, see: WATANABE, K., and others.
HEEZEN, BRUCE C., see: NORTHROP, J., and HEEZEN, B. C.

145. HENSON, F. R. S., Observations on the geology and petroleum occurrences of the Middle East: Third World Petrol. Congress, Proc. Sect. 1, pp. 118–140, 3 pls.

146. HILLY, J., and SIGAL, J., Sur la présence du Sénonien supérieur dans la région d'Herbillon—Cap de Fer (Department de Constantine, Algérie): Soc. géol. France, Comptes rendus, No. 1–2, pp. 26–28.

147. HILTERMANN, H., Adolf Franke, Adalbert Liebus und Ludwig Rhumbler zum Gedenken: Erdöl und Kohle, 4. Jahrg., Heft no. 4, pp. 206–208.

148. HILTERMANN, H., Helen Jeanne Plummer: Ibid., 4 Jahrg. August 1951, no. 8, pp. 528–529.

149. HILTERMANN, H., Populationen in ihrer Bedeutung für die Paläontologie und Stratigraphie: Ibid., 4 Jahrg., no. 5, pp. 244–249, 2 text figs.

150. HILTERMANN, H., (Micropaleontological News): Germany: The Micropaleontologist, vol. 5, no. 2, April, pp. 5–11.
HILTERMANN, H., see: DIETZ, C., and HILTERMANN, H.

151. HOFKER, J., Recent Peneroplidae. Part 1: Roy. Microsc. Soc. Jour., series 3, vol. 71, pt. 2, Sept. 1951, pp. 223–239, 17 text figs.

152. HOFKER, J., Recent Peneroplidae, Part 2: Ibid., series 3, vol. 71, pt. 3, December 1951, pp. 342–356, text figs. 19–35.

152a. HOFKER, J., Recent Peneroplidae. Part 3: Ibid., series 3, vol. 71, part 4, 1951 (published June 1952), pp. 450–463, text figs. 36–51. (No. 375 for the year 1951.)

153. HOFKER, J., On Foraminifera from the Dutch Cretaceous: Natuurhist. Genootsch. in Limburg, Publ., vol. 4, 1951, Aug. 15, 1951, 40 pp., 47 text figs.

154. HOFKER, J., The Foraminifera of the Siboga Expedition. Part 3, Ordo Dentata, Sub-ordines Protoforaminata, Biforaminata, Deuteroforaminata: Siboga-Expeditie, Monographie 4-a; Uitkomsten op Zool., Botan., Oceanogr., en geol. gebied. Leiden (E. J. Brill) 513 pp., 348 text figs.

155. HOFKER, J., The toothplate Foraminifera: Arch. Néerland. de Zool., vol. 8, fasc. 4 (1951), pp. 333–373, 20 text figs.

156. HOFKER, J., Pores of Foraminifera: The Micropaleontologist, vol. 5, no. 4, p. 38.

HOOVER, LINN, JR., see: SNAVELY, P. D., and others.

157. HORNIBROOK, N. DE B., (Micropaleontological News): New Zealand: The Micropaleontologist, vol. 5, no. 1, pp. 16–21.

158. HORNIBROOK, N. DE B., (Micropaleontological News): New Zealand: Ibid., vol. 5, no. 3, p. 11.

159. HORNIBROOK, N. DE B., (Micropaleontological News): New Zealand: Ibid., vol. 5, no. 4, p. 24.

160. HORNIBROOK, N. DE B., Memorial: Harold John Finlay, 1901–1951: Ibid., vol. 5, no. 3, pp. 16–17, 1 portrait.

161. HUSSEY, KEITH M., Two lower Claiborne index fossils: Cushman Found. Foram. Res. Contr., vol. 2, pp. 19–20, pl. 3, figs. 1–3.

162. HUSSEY, KEITH M., and CAMPBELL, C. B., A new method of sample preparation: Jour. Paleontology, vol. 25, pp. 224–226, 2 text figs.

163. HUSSEY, KEITH M., and WEST, GLEN D., Some variations within a species as shown by *Loxostomum gemmum:* Cushman Found. Foram. Res., Contr., vol. 2, p. 19, pl. 3, figs. 4–11.

164. INOUE, HIROO and NAKASEKO, KOJIRO, Foraminifera of the Miocene Sakuma formation, Japan: Geol. Soc. Japan, Jour., vol. 57, no. 664, pp. 7–11, 4 text figs., 1 table.

165. ION, D. C., ELDER, S., and PEDDER, A. E., The Agha Jari Oilfield, Southwest Persia: Third World Petrol. Congr., Proc., Sect. 1, pp. 162–186, 13 text figs., 2 tables.

166. ISRAELSKY, M. C., Foraminifera of the Lodo formation, central California. General introduction and Part 1, Arenaceous Foraminifera (A study of the foraminiferal fauna of a Paleocene and Eocene formation of scientific and economic importance): U. S. Dept. Interior, Geol. Survey, Prof. Paper 240-A, pp. 1–29, pls. 1–11, 2 text figs.

167. JACOB, K., and SASTRI, V. V., Tertiary Foraminifera from Sawy Bay, Car Nicobar Island: Science and Culture (Calcutta), vol. 17, pp. 181–182.

168. JACOB, K., and SASTRI, V. V., The occurrence of *Austrotrillina* in the Quilon limestone, South India: Ibid., vol. 16, pp. 326–327.

169. JELETZKY, J. A., Die Stratigraphie und Belemnitenfauna des Obercampan und Maastricht Westfalens, Nordwestdeutschlands und Dänemarks sowie einige allgemeine Gliederungs-Probleme der jüngeren barealen Oberkreide Eurasiens: Anst. für Bodenforsch., Hannover, Beihefte zum Geol. Jahrbuch Heft 1, 142 pp., 7 pls., 3 tables.

JOBE, BILLYE IRENE, see HARRIS, R. W., and JOBE, B. I.

170. JOHNSON, J. HARLAN, An introduction to the study of organic limestones (revised edition): Colorado School of Mines, Quarterly, vol. 46, no. 2, pp. 1–185, 1 text fig., 104 pls.

JOHST, WALTER, see: KREMP, G., and JOHST, W.

171. JÖRG, ERWIN, Die tertiären Sedimente des Limberges bei Sasbach am Kaiserstuhl: N. Jahrb. f. Geol. und Pal. Monatshefte, Apt. B., pp. 289–304.

172. KENT, P. E., SLINGER, F. C., and THOMAS, A. N., Stratigraphical exploration surveys in Southwest Persia: Third World Petrol. Congr., Proc., Section 1, pp. 141–161, 14 text figs., 1 table.

173. KETIN, A., Über die Geologie der Gegend von Bayburt in Nordost Anatolien: Univ. Istanbul, Revue Fac. Sci., ser. B, vol. 16, pt. 2, pp. 113–127.

173a. KHVOROVA, I. V., Bioherms of Foraminifera in the reef massives of the preuralian region of Ichimbai (in Russian): Akad. Nauk SSSR., Doklady, vol. 78, no. 6, pp. 1193–1194, 2 text figs. (non vidi).

KITAZAKI, UMEKA, see: SUZUKI, K., and KITAZAKI, U.

174. KLEINPELL, ROBERT M., and ARNOLD, ZACH M., Cretaceous in the Philippines (Abstract): Geol. Soc. America, Bull., vol. 62, p. 1455.

175. KNIGHTS, A. J., Micropaleontological technique: Geol. Magazine, vol. 88, no. 2, p. 150

176. KNIPSCHEER, H. C. G., (Micropaleontological News): Germany: The Micropaleontologist, vol. 5, no. 4, pp. 17–19.

KNIPSCHEER, H. C. G., see: WANNER, J., and KNIPSCHEER, H. C. G.

177. KOCHANSKY-DEVIDE, VANDA, Sur la présence du genre *Globotruncana* dans les calcaire des environs de Bor en Serbie orientale: Inst. Géol. Univ. Béograde, Ann. Géol. Peninsule Balkan., vol. 19, pp. 113–117, pl. 1.

178. KOIKE, KIYOSI, Some *Lepidocyclina* from Japan (1) (Japanese with short English summary): Physiograph. Research Inst. Tokyo Univ. Bull., no. 7, 1951, pp. 32–37, 1951, 1 fig., 3 tables.

179. KOIKE, KIYOSI, Some *Lepidocyclina* from Japan (2): Geol. Soc. Japan, Jour., vol. 57, no. 666, pp. 87–93, pl. 2, 7 text figs.

180. KOIKE, KIYOSI, On "The Kurotaki unconformity" (Japanese with short English summary): Ibid., vol. 57, no. 667, pp. 143–156, 12 text figs.

KOIKE, KIYOSI, see: NARUSE Y., and others.

181. KREMP, GERHARD, Foraminiferen- und Ostracoden-Horizonte im Produktiven Karbon des Ruhrgebietes: Bergmann. Zeitschr. "Glückauf," Jahrg. 87, Heft 25/26, pp. 596–600, 1 table.

182. KREMP, GERHARD, and JOHST, WALTER, Einige Mikrofossilien des Oberkarbons und Verfahren zur Gewinnung von Schliffen solcher oft sehr harten Objekte: Geol. Jahrb., Hannover, Bd. 66, pp. 151–164, 3 plates (A, B, C).

183. KRUMBEIN, W. C., and SLOSS, L. L., Stratigraphy and sedimentation: San Francisco, California (W. H. Freeman & Co.), 497 pp., ill.

KUENEN, PH. H., see: NATLAND, M. L., and KUENEN, PH. H.

184. KUGLER, HANS G., and WARING, G. A.,

Frederick Willoughby Penny (1887–1950): Am. Assoc. Petroleum Geologists, Bull., vol. 35, pp. 774–775, 1 portrait.

185. LADD, HARRY C. (Chairman), and others, Report of the Committee on a treatise on marine ecology and paleoecology, no. 11, 1950–1951: Nat. Research Council, Div. of Geol. and Geogr., Washington, D. C., 83 pp., 7 figs., tables.
186. LALICKER, CECIL G., *Pealerina*, new name, replacing *Ellisina* Lalicker: Jour. Paleontology, vol. 25, p. 237.
LANPHERE, C. R., see: TOULMIN, L. D., and others.
LA MOREAUX, P. E., see: TOULMIN, L. D., and others.
187. LENOBLE, A., Notice géologique de Madagascar: Internat. Geol. Congress., 18. Session, Great Britain, 1948, Rept. pt. 14, pp. 143–152.
188. LIPPARINI, TINO, Alloctono di facies umbro-marchigiana adriatica sul bordo orientale dell'autoctono abruzzese (Zona di Casoli, F 147 "Lanciano"): Serv. Geol. Italia, Boll., vol. 72, fasc. 1 (anno 1950), pp. 55–59, 1 text fig.
189. LIPPARINI, TINO, Contribuzioni del laboratorio di micropaleontologia del Servizio Geologico d'Italia. Contribuzione Prima: Foraminiferi del Calabriano in Argille nel sottosuolo di Castel Fusano (Lido di Roma): Ibid., vol. 72, fasc. 1, (anno 1950), pp. 47–48.
190. LIPPARINI, TINO, Contribuzione seconda: Foraminiferi oligocenici negli argilloscisti rossi ("Red Beds") di S. Arcangelo di Lucania: Ibid., vol. 72, fasc. 1 (anno 1950), p. 49, 1 table.
191. LIPPARINI, TINO, Contribuzione terza: Foraminiferi del Miocene inferiore in marne grigie di Trabia Miniere (Sicilia): Ibid., vol. 72 (anno 1950), p. 51.
192. LIPPARINI, TINO, Foraminiferi dell'Oligocene nel Flysh di Cortona (Arezzo): Ibid., vol. 71 (1947–1948), pp. 149–153, 1 pl., Roma 1951.
193. LIPPARINI, TINO, Studio stratigrafico e tettonico della zona di Sogliano al Rubicone (Fogli di Forli e Mercato Saraceno): Ibid., vol. 71 (anni 1947–1949–1949), Roma 1951, pp. 7–14, 1 map.
194. LOEBLICH, ALFRED R., JR., Coiling in the Heterohelicidae: Cushman Found. For. Research, Contr., vol. 2, pt. 3, Oct. 1951, pp. 106–110, 2 text figs., pl. 12.
195. LOEBLICH, ALFRED R., JR., The Cushman Collection of Foraminifera: Jour. Paleontology, vol. 25, p. 227.
196. LOEBLICH, ALFRED R., JR., and TAPPAN, HELEN, Foraminifera: Description of certain species (from Maness shale, Comanche Cretaceous), Texas: in LOZO, FRANK E.: Fondren Science Series, no. 4, Southern Methodist Univ., Dallas, Texas, "The Woodbine and adjacent strata," pp. 82–89, pl. 2.
197. LOWMAN, SHEPARD W., The relationship of the biotic and lithic facies in Recent Gulf Coast sedimentation: Jour. Sediment. Petrology, vol. 21, pp. 233–237.
198. LOZO, FRANK E., Stratigraphic notes on the Maness (Comanche Cretaceous) shale; (Foram. det. by Loeblich and Tappan): "The Woodbine and adjacent strata," Fondren Science Series, no. 4, Southern Methodist Univ., Dallas, Texas, May 4, 1951, pp. 65–92, 2 pls.
LOZO, FRANK E., see: ADKINS, W. S., and LOZO, F. E.
199. LYS, M., *Robulus incisus*, n. sp., phylum caractéristique en Afrique à la limite Crétacé-Eocène: Revue Inst. Français du Petrole et Annales Combust. Liquides, vol. 6, pp. 91–100, pls. 1–3.
200. LYS, M., and GREKOFF, N., Microfaunes du Crétacé supérieur et du Paléocène, leur utilisation en Afrique Equatoriale Française (with discussion by: F. Brotzen, M. Reichel and M. Lys): Third World Petrol. Congr., Proc. Section 1, pp. 490–496, 1 fig., 2 tables.
201. MACVICAR, DONALD G., JR., Extraction of fossils by heat: The Micropaleontologist, vol. 5, no. 3, p. 15.
202. MACVICAR, DONALD G., JR., How to free fossils: Time, April 30, 1951, The Weekly News Mag., vol. 57, no. 18, p. 83.
202a. MALAKHOVA, N. P., Foraminifera of the Carboniferous complex on the western side of the middle and western Urals (in Russian): Akad. Nauk SSSR., Doklady, vol 81, no. 6, pp. 1117–1120 (non vidi).
203. MALKIN, DORIS S., (Micropaleontological News): United States, Gulf Coast: The Micropaleontologist, vol. 5, no. 4, pp. 3–4.
MARIE, P., see: BOURCART, J., and MARIE, P.
MARIE, P., see: GUILCHER, A., et al.
MARKS, JAY G., see: PAGE, B. M., and others.
204. MARKS, PETER, JR., A revision of the smaller Foraminifera from the Miocene of the Vienna Basin: Cushman Found. Foram. Res. Contr., vol. 2, pt. 2, pp. 33–73, pls. 5–8.
205. MARKS, PETER, JR., *Arenonionella*, a new arenaceous genus of Foraminifera from the Miocene of Algeria: Kon. Nederl. Aka. Wetensch. Amsterdam, Proc., series B., vol. 54, no. 4, pp. 375–378, 4 text figs.
MARTIN, LOIS T., in: PAYNE, M. B.
MARTIN, LOIS T., see: SCHENCK, H. G., and MARTIN, L. T.
206. MARTINIS, B., Nuovo contributo alla conoscenza del Pliocene del sottosuolo di Albino (Bergamo): Riv. Ital. Paleont. e Stratigr., vol. 57, no. 2, Milano 1951, pp. 35–48, 1 text fig.
206a. MASLAKOVA, N. I., and MURATOV, M. V., Stratigraphy of the Paleogene deposits of the Eastern Carpathians (in Russian): Akad. Nauk SSSR., Doklady, vol. 81, no. 3, pp. 449–452 (non vidi).
MAUGIS, P., see: GUBLER, Y., and others.
207. MAXIA, C., In memoria del Prof. Giuseppe Checchia-Rispoli: Serv. Geol. Italia, Boll.

vol. 71 (anni 1947–1949), pp. 35–50, 1 photo, bibliogr.

208. MAYNC, W., A correction: The Micropaleontologist, vol. 5, no. 2, p. 24.
209. MCCLELLAN, HUGH W., and HAINES, RICHARD B., San Miguelito oil field, Ventura County, California: Am. Assoc. Petroleum Geologists, vol. 35, pp. 2542–2560, 9 figs.
210. MCCONNELL, R. B., La nappe du Niesen et ses abords entre les Ormonts et la Sarine: Beitr. Geol. Karte d. Schweiz, N.S. 95. livr. (125 de la collect. entière) 94 pp., 28 figs., 2 pls.
211. MCLAUGHLIN, KENNETH P., and SIMONS, MERTON E., Upper Paleozoic microfossils from Stevens County, Washington: Jour. Paleontology, vol. 25, pp. 514–519, pls. 76, 2 tables.
212. MCLEAN, JAMES D., JR., McLean card catalogue of American Foraminifera; units 2 to 9 incl., 5×8″ cards, illustr.: James D. McLean, Jr., P.O. Box 916, Alexandria, Virginia.
213. MCLEAN, JAMES D., JR., Paleocene Foraminifera from the Atlantic Coastal Plain: Cushman Found. Foram. Res., Contr., vol. 2, pp. 20–29, pl. 4
214. MCLEAN, JAMES D., JR., *Cibicides* or *Eponides cocoaensis* Cushman: Jour. Paleontology, vol. 25, pp. 534–535.
215. MCLEAN, JAMES D., JR., Comparison microscope—a tool with unique possibility: Amer. Assoc. Petroleum Geologists, Bull., vol. 35, pp. 96–101, 4 figs.
216. MERCIER, JEAN, Observations à propos d'une série bitumineuse dans le Paléozoique d'Hazro (Anatolie sud-orientale): Acad. Sci. Paris, Comptes-rendus, tome 233, pp. 1207–1208.

MERRIAM, RICHARD H., see: BANDY, O. L., and MERRIAM, R. H.

MESSINA, ANGELINA R., see: ELLIS, B. F., and MESSINA, A. R.

MICHEL, P., see: GUBLER, Y., and others.

MIKLUKHO-MAKLAJ, A. D., see: VISTELIUS, A. B., and MIKLUKHO-MAKLAJ, A. D.

217. MONTANARO GALLITELLI, EUGENIA, Il Postpliocene marino nella regione collinare a sinistra del F. Secchia (Appennino modernese-reggiono): Centro Studi Geol. Appennino, Publ., No. 10, Consiglio Nazionale della Ricerche, pp. 89–101, 3 text figs., 3 tables. (ex: Soc. Geol. Italia, Boll, vol. 69 (1950) Roma 1951.
218. MOORE, RAYMOND C., Helen Jeanne Plummer, 1891–1951 (Memorial): The Micropaleontologist, vol. 5, no. 2, pp. 28–30, 1 portrait.
219. MORDOJOVICH, CARLOS, (Micropaleontological News): Chile: Ibid. vol. 5, no. 4, pp. 10–12, 1 sketch-map.
220. MORETTI, A., Notizie geologiche e morfologiche sul gruppo del Gran Sasso d'Italia: Serv. Geol. Italia, Boll., vol. 71 (anni 1947–49), pp. 77–111, 1 map, 3 text figs.
221. MORIKAWA, ROKURO, *Nagatoella fujimotoi*, n. sp., and a new studying method for fusulinids: Paleont. Soc. Japan, Trans., Proc., n.s., no. 3, pp. 81–84, pl. 8.
222. MURAOUR, PIERRE, Remarques sur le Numidien de la région de Tigzirt (Algérie): Acad. Sci. Paris, Comptes-rendus, vol. 232, pp. 246–248.
223. MURAOUR, PIERRE, Sur la présence du Sénonien au N.E. du Bordj Menaiel (Algérie): Soc. géol. France, Comptes-rendus, pp. 155–156.
224. MURAOUR, PIERRE, Sur une coupe levée dans la région d'Oulad Ahmed ben Aissa (Algérie-carte Dellys-Tizi Ouzon): Ibid., Comptes-rendus, pp. 183–185.
225. MURATA, SIGEO, On the paleo-ecological investigation of the fossil foraminiferal fauna in the Miyazaki group, with description of new species: Kyushu Inst. of Technology, Bull. No. 1, March 1951 (Tobata City, Japan), pp. 91–104, 1 pls., 6 tables, 1 fig.
226. MURATA, SIGEO, Miocene *Cyclammina* in the vicinity of Matsue City, Shimane Prefecture (Japanese with English résumé): Geol. Soc. Japan, Jour., vol. 57, no. 675, December 1951, pp. 509–510.
227. MURATA, SIGEO, The occurrence of the genus *Cyclammina* in the Tertiary of Kyushu: Paleont. Soc. Japan, Trans. Proc., n.s. no. 3 pp. 65–66, 1 table.

MURATOV, M. V., see: MASLAKOVA, N. I., and MURATOV, M. V.

228. NAGAHAMA, MASAHO, Studies on the foraminiferal fauna of small or almost enclosed bays in Japan (Japanese with English abstract): Res. Inst. Natural Resources, Misc. Reports, nos. 19–21, pp. 142–148.
229. NAGAPPA, Y., The stratigraphical value of *Miscellanea* and *Pellatispira* in India, Pakistan and Burma: Indian Acad. Sci. Proc., vol. 33, no. 1, Sect. B, pp. 41–48, 1 fig.

NAKASEKO, KOJIRO, see: INOUE, H., and NAKASEKO, K.

NÄNNY, PAUL, see: ALLEMANN, F., and others.

230. NAPOLI ALLIATA, E. DI, Considerazioni sulle microfaune del Miocene superiore Italiano: Rivist. Ital. di Paleont. e Stratigr; vol. 57, no. 4, pp. 91–122, pls. 4–6.
231. NAPOLI ALLIATA, E. DI, (Micropaleontological News): Italy: The Micropaleontologist, vol. 5, no. 1, pp. 6–10.
232. NARUSE, YO, SUGIMURA, ARATA, and KOIKE, KIYOSI, Zur Geologie des südlichsten Teils der Halbinsel Bôsô in Honsiu, Japan (Japanese with German summary): Geol. Soc Japan, Jour., vol. 67, no. 675, pp. 511–526, 15 figs.
233. NATHAN, HANS, Festrede über die Persönlichkeit Carl Wilhelm von Gümbels: Geologica Bavarica, no. 6 (München), pp. 16–25, 1 portrait.
234. NATLAND, M. L., and KUENEN, PH. H., Sedimentary history of the Ventura Basin, California, and the action of turbidity currents: Soc. Econ. Pal. and Min., Spec. Publ., no. 2, pp. 76–107, 25 text figs.

235. NEBERT, K., Sedimentologisch-stratigraphische Untersuchungen im Jungtertiär südwestlich von Hartberg (Oststeiermark): Berg-Hüttenmänn. Monatshefte Oesterreich (1951), vol. 96, no. 3, pp. 50–57, illustr.
236. NESTEROFF, W., Quelques précisions sur le pli chevauchant de Terres-Pleines (Ubaye): Soc. géol. France, Comptes-rendus, pp. 214–215.
237. NEVE, G. A. DE, Bibliography of micropalaeontological publications concerning Indonesia and covering the period 1940–1950: De Ingenieur in Indonesia, vol. 3, no. 1, pp. iv.6–iv.11.
238. NEVE, G. A. DE, Supplement to Bibliography of micropalaeontological publications concerning Indonesia and covering the period 1940–1950: Ibid., vol. 3, pp. iv.11–iv.12.
239. NEVE, G. A. DE, (Micropaleontological News): East Indies: The Micropaleontologist, vol. 5, no. 4, pp. 25–29.
NICHOLS, I. K., see: STEIG, M. H., and others.
240. NORTHROP, JOHN, and HEEZEN, BRUCE C., An outcrop of Eocene sediment on the continental slope (Foram. det. by S. K. Fox): Jour. of Geology, vol. 59, pp. 396–399, pl. 1, 1 text fig.
241. NOTH, R., Foraminifera aus Unter- und Oberkreide des österreichischen Anteils an Flysch, Helvetikum und Vorlandvorkommen: Geol. Bundesanst. Wien, Jahrg., Sonderband 3, 91 pp., 9 pls., 2 tables.
242. NOTH, R., Tentative correlation of the Upper Cretaceous of Austria with that of the Gulf Coast and Mexico: The Micropaleontologist, vol. 5, no. 4, pp. 35–38.
243. NOVITZKY, ALEJANDRO, Diccionario minero-metalurgico-geologico, mineralogico-petrografico y de petroleo (Ingles-Español, Frances, Alemán, Ruso), 18,000 words: Buenos Aires, 1951, 369 pp.
244. NUÑEZ JIMENEZ, ANTONIO, Organismos microscopicos formadores del mundo: Revista "Carteles," La Habana, Cuba, January 14, 1951, no. 2, pp. 34–35, 5 text figs.
NUTTALL, W. L. F., see: EAMES, F. E.
245. NYHOLM, KARL-GEORG, A monothalamous foraminifer, *Marenda nematoides*, n. gen., n. sp.: Cushman Found. Foram. Res., Contr., vol. 2, pt. 3, Oct. 1951, pp. 91–95, pl. 11, figs. 1–3, text figs. 1–14.
246. OGDEN, LAWRENCE, Mississippian and Pennsylvanian stratigraphy, Confusion Range, west-central Utah: Amer. Assoc. Petroleum Geologists, Bull., vol. 35, pp. 62–82, 12 figs.
247. OINOMIKADO, TSUNETERU, Bibliography of Japanese papers on Cenozoic and Recent Foraminifera published prior to 1950: Tokyo, Japan (Hosokawa Printing Co.), 19 pp.
248. OINOMIKADO, TSUNETERU, (Micropaleontological News): Japan: The Micropaleontologist, vol. 5, no. 2, pp. 16–21.
249. ONUKI, YOSHIO, On the crustal movements of late Paleozoic and early Mesozoic Era in northern China: Geol. Soc. Japan, Jour., vol. 67, no. 675, pp. 527–537, 2 figs.
250. OVEY, CAMERON C., (Micropaleontological News): Great Britain: The Micropaleontologist, vol. 5, no. 3, p. 4.
251. PAGE, BEN M., MARKS, JAY G., and WALKER, GEORGE W., Stratigraphy and structure of mountains northeast of Santa Barbara, California: Amer. Assoc. Petroleum Geologists, Bull., vol. 35, pp. 1727–1780, 16 figs.
252. PARÉJAS, EDOUARD, and CAROZZI, ALBERT, Observations micrographiques sur le Crétacé supérieur du Roc-de-Chère (lac d'Annecy): Soc. Phys. Hist. Nat. Genève, Arch. des Sci., vol. 4, fasc. 6, pp. 422–426, 2 text figs.
253. PARÉJAS, EDOUARD, and CAROZZI, ALBERT, Rythmes de sédimentation dans le Crétacé supérieur de la Rivière près de Chésery (Ain., France): Archives des Sciences (Genève), vol. 4, pp. 129–134, 1 text fig.
PARKER, FRANCES L., see: PHLEGER, F. B., et al.
254. PAYNE, MAX B., Type Moreno formation and overlying Eocene strata on the west side of the San Joaquin valley, Fresno and Merced counties, California (with Appendix B, fossil registers by H. G. Schenck and Lois T. Martin): State of Calif., Dept. of Nat. Resources, Div. Mines, Spec. Rept. 9, August 1951, 29 pp., 11 text figs., tables, 5 pls.
PEDDER, A. E., see: ION, D. C., and others.
PEIRSON, JEAN F., see: PHLEGER, F. B., et al.
PEREBASKINE, V., see: GUBLER, Y., and others.
255. PHLEGER, FRED B., Displaced Foraminifera faunas: Soc. Econ. Pal. and Min., Spec. Publ., no. 2, pp. 66–75, text figs. 1–7.
256. PHLEGER, FRED B., Ecology of Foraminifera, northwest Gulf of Mexico. Part 1, Foraminifera distribution: Geol. Soc. America, Memoir 46, pp. 1–88, 2 pls., 33 figs., 37 tables.
257. PHLEGER, FRED B., and PARKER, FRANCES L., Ecology of Foraminifera, northwest Gulf of Mexico. Part 2, Foraminifera species: Ibid., Memoir 46, pp. 1–64, 20 pls.
258. PHLEGER, FRED B., PARKER, FRANCES L., and PEIRSON, JEAN F., Foraminifera in North Atlantic deep sea cores (Abstract): Ibid., Bull., vol. 62, p. 1470.
259. PLUMMER, HELEN JEANNE, Foram surgery: The Micropaleontologist, vol. 5, no. 1, pp. 26–28, 6 figs.
260. POKORNY, VLADIMIR, The Middle Devonian Foraminifera of Celechovice, Czechoslovakia: Vestn. Kralov. Ceske Spolecn. Nauk, Trida Matemat. Prirodov. rocnik 1951, cisclo 9, pp. 1–29, pls. 1, 2, 17 text figs.
261. POKORNY, VLADIMIR, Stari zavalku a puvod fauny y tortonskych piscich u Zabcic—The age of the clay-balls and the origin of fauna in the Tortonian sands at Zabcice (Moravia, Extra-alpine Neogene Basin): Vestn. K. Cseske Spolecn. Nauk Trida Matemat.-

Prirodov, rocn. 1951, cisclo 8, 7 pp., Czechoslovakian with summary in English.

262. POKORNY, VLADIMIR, *Thalmannammina*, n. g. (Foraminifera) z Karpatskeho flyse—*Thalmannammina*, n. g. (Foraminifera) from the Carpathian Flysch: Sbornik Ustredn. Ust. Geol. Venovang k. Sedesat. Prof. c Radima Kettnera, Svazek 18, 1951, pp. 469–480, 3 text figs., Czechoslovakian and English.

263. PONTE RODRIGUEZ, LUIS, Depositos fosfaticos del Cerro Riecito, Estado Falcon: Venezuela, Minist. Minas e Hydrocarb., Direcc. Geol. Boletin de Geologia, vol. 1, no. 1, 1951, pp. 9–37, with graphs.

264. POST, RITA J., Foraminifera of the south Texas coast: Inst. Marine Science, Publ., vol. 2, pp. 165–176, pl. 1, 1 table.

265. RAADSHOOVEN, B. VAN, On some Paleocene and Eocene larger Foraminifera of western Venezuela (with discussions by: M. G. Rutten, T. F. Grimsdale and W. Storrs Cole): Third World Petrol. Congr., Proc., Sect. 1, pp. 476–489, 3 pls., 1 map, 20 text figs.

266. RAT, PIERRE, L'Albien supérieur marin dans la série schisto-gréseuse du Sud-Ouest de la Biscaye: Acad. Sci. Paris, Comptes-rendus, vol. 232, pp. 2115–2117.
RAT, PIERRE, see: CIRY, R., and RAT, P.

267. RAU, WELDON W., Tertiary Foraminifera from the Willapa River valley of southwest Washington: Jour. Paleontology, vol. 25, pp. 417–453, pls. 63–67, 3 text figs.
RAU, WELDON W., see: SNAVELY, P. D., and others.

268. REICHEL, M., An adjustable model of milioline coiling: The Micropaleontologist, vol. 5, no. 1, pp. 23–25, 4 text figs.

269. REICHEL, M., (Micropaleontological News): Switzerland: Ibid., vol. 5, no. 4, pp. 20–22.

269a. REICHEL, M., *Fusarchais bermudezi*, n. gen., n. sp., Pénéroplidé alvéoliniforme de l'Oligo-Miocène de Cuba: Eclog. geol. Helvetiae, vol. 44, no. 2, pp. 458–464, 5 text figs. (No. 372 for the year 1951).

270. RENZ, H. H., *Globorotalia lacerti* Cushman & Renz from the Lizard Springs formation of Trinidad, B.W.I. (a correction): Cushman Found. Foram. Research, Contr., vol. 2, p. 29.

271. RENZ, H. H., Remarks on the age of the Lizard Springs formation of Trinidad, B.W.I.: Ibid., Contr., vol. 2, pp. 15–16.

272. RENZ, O., Ricerche stratigrafiche e micropaleontologiche suela Scaglia (Cretaceo-superiore-Terziario) dell'Appennino Centrale: Mem. Descritt. Carta Geol. Italia vol. 29, 173 pp., 15 pls., 14 text figs.

273. REVELLE, ROGER, Paleoecology and deep sea exploration: Rept. no. 11, Comm. Treatise Marine Ecol. & Paleoecol. Div. Geol. & Geogr., Nat. Research Council, Washington, pp. 57–61.

274. REY, M., (Micropaleontological News): North Africa, Algeria, Tunisia, Morocco: The Micropaleontologist, vol. 5, no. 2, pp. 14–16.

275. RITSEMA, L., Description de quelques Alvéolines de Timor; resultat d'une elaboration de la methode des courbes d'indice de Reichel: Kon. Nederl. Akad. Wetensch. Proc., series B., vol. 54, no. 2, pp. 174–182, 4 figs.
ROBERTS, ALBERT E., see: SNAVELY, P. D., and others.

276. ROCHET, JEAN, Observations nouvelles sur l'extrémite Sud du synclinal de Thones (Massif des Bornes, Haute-Sovoie): Acad. Sci. Paris, Comptes-rendus, vol. 232, pp. 340–342.

277. ROSSI RONCHETTI, C., Contributo del *Nummulites gizehensis* alla paleoclimatologia: Riv. Ital. Pal. e Stratigr., vol. 57, no. 3, p. 86.

278. ROTTGARDT, DIETRICH, Mikro-organismen im Unteroligozän von Baden-Baden: Naturwiss. Ver. Schleswig-Holstein Schriften, Bd. 25, Karl Gripp- Festschrift., pp. 38–4.

279. RUSCELLI, M. A., Contributo allo studio morfologico e microfaunistico dei fondi marini: Riv. Ital. di Paleont. e Stratgr., vol. 57, no. 3, p. 85.
SACAL, V., see: CUVILLIER, J., and SACAL, V.
SACAL, V., see: CUVILLIER, J., and others.

280. SAID, RUSHDI, A method of storing larger Foraminifera for variation study: Cushman Found. For. Res. Contr., vol. 2, pt. 4, pp. 138–139, 1 text fig.

281. SAID, RUSHDI, Foraminifera of Narragansett Bay: Ibid., vol. 2, pt. 3, October, 1951, pp. 75–86, 4 text figs. (maps) 2 tables.

282. SAID, RUSHDI, Preliminary note on the spectroscopic distribution of elements in the shells of some recent calcareous Foraminifera: Ibid., vol. 2, pp. 11–13, 1 table.

283. SAID, RUSHDI, Restudy of the "races" of *Nummulites gizehensis:* Ibid., vol. 2, pt. 4, pp. 119–130, 9 text figs., 6 tables.

284. SAID, RUSHDI, Ecology of Foraminifera: The Micropaleontologist, vol. 5, no. 3, pp. 12–14.
SASTRI, V. V., see: JACOB, K., and SASTRI, V. V.

285. SCHAUB, HANS, Die Stratigraphie des Schlierenflysches: Verkürzte Fassung, Inaug. Diss. (Ph.D. Thesis), Univ. Basel, Switzerland, 16 pp., 1 text fig., 1 table.

286. SCHAUB, HANS, Stratigraphie und Paläontologie des Schlierenflysches mit besonderer Berücksichtigung der paleocaenen und untereocaenen Nummuliten und Assilinen: Schweiz. Paläont. Abhandl., Bd. 68, Basel 1951, pp. 1–222, 9 pls., 336 text figs., 1 table.

287. SCHENCK, H. G., and MARTIN, LOIS T., Microfossil register (Appendix B: fossil register) in MAX B. PAYNE: Type Moreno formation and overlying Eocene strata on the west side of the San Joaquin valley, Fresno and Merced counties, California: State of Calif., Dept. Nat. Resources, Div. Mines, Spec. Rept. 9, pp. 25–26.

287a. SCHWEIGHAUSER, JAKOB, Ein Vorkommen von *Neoalveolina* aus dem vicentinischen Obereocaen: Eclog. geol. Helvetiae, vol. 44, no. 2, pp. 465–469, 5 text figs. (No. 373 for the year 1951).

288. SELLIER DE CIVRIEUX, JEAN MARC, Ocurrencia del genero *Globivalvulina* en el Permiano de Venezuela: Bol. de Geol. (Caracas), vol. 1, no. 1 (Minist. Min. e Hidrocarb., Dir. Geol.), pp. 143–146, 2 tables, 1 pl.
289. SELLIER DE CIVRIEUX, JEAN MARC, Ocurrencia en Venezuela de *Trocholina arabica* Henson: Ibid., vol. 1, no. 2, pp. 223–228, 1 fig., 1 pl.
290. SHEPARD, FRANCIS P., Sand and gravel in deep-water deposits: World Oil, vol. 132, no. 1, pp. 61–68, 3 figs.
291. SHINOHARA, I., Illustrated catalogue of fossils from Shikoku, Japan: Tokyo, 11 pp., 13 pls., map.
292. SIDWELL, RAYMOND, and WARN, G. FREDERICK, Pennsylvanian sedimentation in northeastern Socorro County, New Mexico: Jour. Sediment. Petrology, vol. 21, pp. 3–11, 2 pls., 1 fig.
SIGAL, J., see: DUBOURDIEU, G., and SIGAL, J.
SIGAL, J., see: HILLY, J., and SIGAL, J.
SIMONS, MERTON, E., see: MCLAUGHLIN, K. P., and SIMONS, M. E.
293. SINGH, S. N., Kirthar Foraminifera from Rajasthan: Current Science, Sept. 1951, no. 20, p. 230.
SLINGER, F. C., see: KENT, P. E., and others.
SLOSS, L. L., see: KRUMBEIN, W. C., and SLOSS, L. L.
294. SMITH, J. E., The Cretaceous limestone producing areas of the Mara and Maracaibo district, Venezuela (with discussions by V. C. Illing, W. Hegwein, L. C. Stevens, D. C. Ion, and J. E. Smith, pp. 71–72): Third World Petroleum Congr., Proc., Sect. 1, pp. 56–72, 23 text figs.
295. SMYTH, PAULINE, Fusulinidae in the Pennsylvannian of Ohio (Abstract): Geol. Soc. America Bull., vol. 62, p. 1481.
296. SNAVELY, PARKE D., RAU, W. W., HOOVER, L., JR., and ROBERTS, A. E., McIntosh formation, Centralia-Chehalis coal district, Washington: Am. Assoc. Petroleum Geologists, Bull., vol. 35, pp. 1052–1061, 6 figs.
297. SOCIÉTÉ CHÉRIFIENNE DES PÉTROLES, Un gisement dans les schistes fracturés du socle l'Oued Beth (Maroc Français): Third World Petrol Congress, Proc. Sect. 1, pp. 315–328, 6 figs.
STACH, LEO W., see: ASANO, K., and STACH, L. W.
297a. SPASOV, K., Tortonische Foraminiferen von Staropatitza bei Koula. (Bulgarian with summary in German): Geol. Inst. Bulgaria, Izvest., vol. 1, pp. 103–124, 2 pls. (non vidi).
298. STAINFORTH, R. M. (Micropaleontological News): Peru, The Micropaleontologist, vol. 5, no. 1, p. 5.
299. STAINFORTH, R. M., (Micropaleontological News): Peru: Ibid., vol. 5, no. 3, p. 3.
300. STAINFORTH, R. M., Growth of recognition of the zonal value of planktonic microfossils: Ibid., vol. 5, no. 4, pp. 30–32.
STAINFORTH, R. M., see: CUSHMAN, J. A., and STAINFORTH, R. M.
301. STEENHUIS, J. F., Opgave van geschriften over Geologie en Mijnbouw van Indonesie (Drie-en-twintigste Vervolg), (over 1937–1947): Nederlandsch Geol. Mijnbouwk. Genootsch. deel 4, Geol. Mijnbouwk. Bibliogr. van Indonesie, aflev. 5–10, pp. 37–118.
302. STEIG, M. H., NICHOLS, I. K., GRAY, S. G., and DENHAM, R. L., Geology of Erath Field, Vermilion Parish, Louisiana: Am. Assoc. Petroleum Geologists, Bull., vol. 35, pp. 943–987, 28 figs.
303. STONE, BENTON, A new species of Foraminifera from Peru: Cushman Found. For. Res. Contr., vol. 2, p. 9, pl. 2, fig. 1.
304. STONE, BENTON, *Lagena samanica*, a synonym: Ibid., vol. 2, pt. 4, p. 139.
305. STROMER, ERNST, Geht die Entwicklung der Tierwelt noch weiter?: Paläont. Zeitschr. vol. 24, pp. 66–71.
SUGIMURA, ARATA, see: NARUSE, Y., and others.
306. SUJKOWSKI, ZB. L., A pebble with Radiolaria from the 100-ft. terrace at Swanscombe, Kent: Geol. Magazine, vol. 88, pp. 354–356.
307. SUZUKI, KOITI and KITAZAKI, UMEKA, Applied micropaleontological studies of the Cenozoic formations in the northern part of Miura Peninsula: Geol. Soc. Japan, Jour., vol. 57, no. 665, pp. 65–76, 9 text figs., 1 table (in Japanese), pp. 77–78 (abstract in English).
308. TAKAYANAGI, YOKICHI, On some *Ehrenbergina* from Japan: Paleont. Soc. Japan, Trans., Proc., n.s. no. 3, pp. 85–93, 18 text figs., 1 table.
309. TAPPAN, HELEN, Foraminifera from the Arctic slope of Alaska; General introduction and part 1: Triassic Foraminifera: U. S. Geol. Survey, Prof. Paper 236-A, 20 pp., 5 pls., 2 figs.
310. TAPPAN, HELEN, Micropaleontology. (Fig. 21: Index Foraminifera of northern Alaska) in: PAYNE, THOMAS G. and others: Geology of the Arctic slope of Alaska: U. S. Dept. Interior, Geol. Survey, Oil and Gas Investig. Map, OM 126, sheet 3, 1 p., fig. 21.
311. TAPPAN, HELEN, Northern Alaska index Foraminifera: Cushman Found. Foram. Res., Contr., vol. 2, pp. 1–8, pl. 1.
312. TASMAN, CEVAT, and EGERAN, NECDET, On the oil possibilities of Turkey with special reference to the Raman field: Third World Petrol. Congr., Proc., Sect. 1, pp. 187–198, 6 figs.
313. TEICHERT, CURT, The marine Permian faunas of Western Australia (an interim review): Paläont. Zeitschr., vol. 24, pp. 7–90, 1 text fig.
314. TELLEZ-GIRON,, C. (Micropaleontological News), Mexico: The Micropaleontologist, vol. 5, no. 1, pp. 2–3.
315. TELLEZ-GIRON, C., (Micropaleontological News) Mexico: Ibid., vol. 5, no. 2, pp. 2–3.
316. TELLEZ-GIRON, C., (Micropaleontological News) Mexico: Ibid., vol. 5, no. 3, pp. 2–3.
317. TELLEZ-GIRON, C., (Micropaleontological News) Mexico: Ibid., vol. 5, no. 4, pp. 6–7.
318. THALMANN, HANS E., (Micropaleontological

News) United States: West Coast: Ibid., vol. 5, no. 4, pp. 5–6.

THOMAS, A. N., see: KENT, P. E., and others.

319. THOMPSON, M. L., (Micropaleontological News) United States: North-Central Region The Micropaleontologist, vol. 5, no. 4, pp. 2–3.

320. THOMPSON, M. L., New genera of fusulinid Foraminifera: Cushman Found. Foram. Res. Contr., vol. 2, pt. 4, pp. 115–119, pls. 13, 14 2 tables.

321. THOMPSON, M. L., Wall structures of fusulinid Foraminifera: Ibid., vol. 2, pt. 3, Oct. 1951, pp. 86–91, pls. 9, 10, 1 text fig.

322. TILEV, NUH, Etude des Rosalines maestrichtiennes (genre *Globotruncana*) du Sud-Est de la Turquie (sondage de Ramandag): Maden Tetkik ve Arama Enstit. Yayinlar., Publ. Inst. Etudies et Recherches Minières de Turquie, Série B., no. 16, 101 pp., 3 pls., 25 figs. text.

323. TODD, RUTH, Recent literature on the Foraminifera: Cushman Found. Foram. Res., Contr., vol. 2, pp. 30–32.

324. TODD, RUTH, Recent literature on the Foraminifera: Ibid., vol. 2, pt. 3, pp. 111–113.

325. TODD, RUTH, Recent literature on the Foraminifera: Ibid., vol. 2, pt. 4, pp. 147–14.

326. TOLUN, NECIB, Etude géologique du bassin nord-est de Diyarbakir: Maden Tetkik ve Arama Enstit, M. T. A., no. 41, pp. 65–98, 13 text figs., 1 map, 1 section.

327. TOULMIN, L. D., LA MOREAUX, P. E., and LANPHERE, C. R., Geology and groundwater resources of Choctaw County, Alabama: Geol. Survey Alabama, Spec. Rept. 21, and County Rept. 2, 197, pp., 23 figs., 11 pls., 2 maps, 4 tables.

328. TROMP, S. W., The geological history of Egypt and the Red Sea in particular: Turk. Jeol. Kurumu Bult., (Bull. Geol. Soc. Turkey), vol. 3, no. 1, Jan., 1951, pp. 55–95.

329. TURKUNAL, SULEYMAN, Note sur la geologie des Montagnes de Hakkari: Ibid., vol. 3, no. 1, Jan. 1951, pp. 33–43.

330. UCHIO, TAKAYASU, Foraminiferal study of Tertiary formations near Otaki Gas-field, Chiba Prefecture: Geol. Soc. Japan, Jour., vol. 57, no. 664, pp. 13–20, 2 text figs., (Japanese with English résumé).

331. UCHIO, TAKAYASU, New species of Foraminifera of the Miocene age in Tochigi Prefecture, Japan: Ibid., vol. 57, no. 671, pp. 369–377, 1 pl., 2 text figs.

332. UCHIO, TAKAYASU, New species and genus of the Foraminifera of the Cenozoic formations in the middle part of the Bôsô Peninsula, Chiba-Ken, Japan: Paleont. Soc. Japan, Trans., Proc., n.s., no. 2, pp. 33–42, pl. 3, 1 text fig.

333. VASIČEK, MILOSLAV, Origin of pseudoassociations of microfossils: Geol. Surv. Czechoslov. Sborn, vol. 18, Paleontology, pp.129–144, 2 text figs., pls. 1–4 (15–18).

334. VASIČEK, MILOSLAV, Preliminary report on the microbiostratigraphy of the earlier Neogene of southern Moravia: Ibid., vol. 18, Paleontology, pp. 97–100, 1 table.

335. VASIČEK, MILOSLAV, Representatives of the genus *Hantkenina* in the Paleogene of Moravia: Ibid., vol. 18, Paleontology, pp. 101–128, 84 text figs., ps. 4 (14).

336. VASIČEK, MILOSLAV, The contemporary state of microbiostratigraphic research of the Miocene sedimentary deposits in the Out-Carpathian Neogene Basin in Moravia: Ibid., vol. 18, Paleontology, pp. 145–195, 7 text figs., 2 tables, pls. 1, 2 (19, 20).

337. VASIČEK, MILOSLAV, The representatives of the genus *Stensiöina* from the Morovian Flysch: Ibid., vol. 18, Paleontology, pp. 85-96, 1 table, pls. 1, 2 (12, 13).

338. VASIČEK, M., Zprava o mikropaleontologickych vyzkumech (Compte rendu des recherches micropaléontologiques): Vestr. Ustred. Ustav. Geol., vol. 26, 1951, pp. 142–145 (Czechosl. text).

339. VASIČEK, M., Novy mikropaleontologicky dukaz o mladotretihorni horotvorne fazi na vychnodi Morave (A new micropaleontologic evidence in the late-Tertiary orogeny in East Moravia): Sborn. Ustred. Ustav. Geol., vol. 18, 1951, pp. 501–526 (Czech. text), pp. 527–552 (Engl. text), 1 text fig., pls. 1–3 (41–43), 1 table.

340. VAVRINOVA, MILADA, Vyzkum barvicich method a jejich pouziti pri rozlisovani uzce pribuznych druhu foraminifer (Investigation of the colouring methods and their use in distinguishing closely related species of Foraminifera): Vestn. Ustred. Ustav. Geol., vol. 26, pp. 334–338, Engl. summary, pp. 339–340.

341. VIALLI, V., Diagnosi di forme nuove: *Discorbis magna*, n. sp.: Riv. Ital. Pal. e Strat. vol. 57, p. 23, text fig. 3 (Latin diagnosis).

342. VIALLI, V., I Foraminiferi Luteziano-Priaboniani del Monte Orobio (Adda de Paderno): Atti Soc. Ital. Sci. Nat., Museo Civico Stor. Nat. Milano, vol. 90, fasc. 2–3, 1951, pp. 97–168, pls. 5–7, 2 text figs.

343. VIGNEAUX, MICHEL, L'Eocène inférieur sur le versant Nord de l'anticlinal de Vallagrains-Landiras (Gironde): Acad. Sci. Paris, Comptes-rendus, vol. 232, pp. 1768–1769.

343a. VISTELIUS, A. B., and MIKLUKHO-MAKLAJ, A. D., On the Paleozoic pebbles of the productive complex of the Apsheron Peninsula (in Russian): Akad. Nauk SSSR., Doklady, vol. 79, No. 3, pp. 499–502 (non vidi).

344. VOIGT, EHRHARD, Das Maastricht-Vorkommen von Ilten bei Hannover und seine Fauna mit besonderer Berücksichtigung der Gross-Foraminiferen und Bryozoen: Geol. Staats-Institut Hamburg, Mitt. Heft 20, pp. 15–109, 15 text figs., pls. 1–10.

345. VOORTHUYSEN, J. H. VAN, (Micropaleontological News): Benelux (Belgium, Netherlands, Luxembourg): The Micropaleontologist, vol. 5, no. 1, pp. 11–13.

346. VOORTHUYSEN, J. H. VAN, (Micropaleontological News): Benelux: Ibid., vol. 5, no. 4, pp. 13–17.

347. VOORTHUYSEN, J. H. VAN, Recent (and derived Upper Cretaceous) Foraminifera of the Netherlands Wadden Sea (tidal flats): Geol. Stichting Haarlem, Mededeel., n. s. no. 5, pp. 23–32, pls. 1, 2, 1 map, 1 table.

348. VOORTHUYSEN, J. H. VAN, The qualitative distribution of the Holocene Foraminifera in the N. O. Polder: Third Internat. Congr., Sedimentology, Groningen-Wageningen, Netherlands 1951, Proc., pp. 267–272, 2 pls.

VOUTE, C., see: DROOGER, C. W., and VOUTE, C.

WALKER, GEORGE W., see: PAGE, B. M., and others.

349. WALTHER, HANSJUST, Jurassische Mikrofossilien, insbesondere Gastropoden, am Südrand des Hils. (Ergebnisse einer Kartierung nach Mikrofaunen): Paläont. Zeitschrift, vol. 25, pp. 35–106, pls. 2–5, 5 text figs.

350. WANNER, J., and KNIPSCHEER, H. C. G., Beiträge zur Paläontologie des Ostindischen Archipels: 20. Neue Versteinerungen an den norischen *Nucula*-Mergeln von Misol: Neues Jahrheft f. Geol. u. Palaont. Abh., vol. 94, pp. 49–66, pl. 5.

WARING, GERALD A., see: KUGLER, H. G., and WARING, G. A.

WARN, G. FREDERICK, see: SIDWELL, R., and WARN, G. F.

351. WATANABE, KAGETAKA, ARAI, JUZO and HAYASHI, TADAICHI, Tertiary geology of the Chichibu Basin (Japanese with English abstract): Chichibu Nat. Sci., Mus. Rept. no. 1, pp. 29–92, pls. 1–6, 17 figs., 1 map.

352. WEBER, HANS, Mikropaläontologische Untersuchungen im Tertiär des Rheintalrandes bei Wiesloch in Baden: Erdöl und Kohle, 4. Jahrg. Sept. 1951, no. 9, pp. 543–549, 5 figs., 1 table.

WEST, GLEN D., see: HUSSEY, K. M., and WEST, G. D.

353. WESTERMANN, J. H., The water bore of Oranjestad 1942–1943, and its implication as to geology and geohydrology of the island of Aruba (Netherlands West Indies) 1: Kon. Nederl. Akad. Wetensch. Proc., Series B., vol. 54, no. 2, pp. 140–150, 3 figs.

354. WETZEL, OTTO, Mikroskopische Reste von Kalkorganismen als Feuersteinfossilien besonderen Aussehens: N. Jahrb. f. Geol. u Paläont., Abh., Bd. 94, pp. 112–120, pl. 14.

355. WEYNSCHENCK, ROBERT, A method in sedimentary petrology opening new views on oil research and questions of ecology: The Micropaleontologist, vol. 5, no. 2, pp. 25–27.

356. WEYNSCHENCK, ROBERT, Two new Foraminifera from the Dogger and Upper Triassic of the Sonnwend Mountains of Tyrol: Jour. Paleontology, vol. 25, pp. 793–795, pl. 112, 3 text figs.

357. WICHER, C. A., Zur mikropaläontologischen Gliederung des nichtmarinen Rät: Erdö und Kohle, 4 Jahrg., pp. 755–760, 1 pl., 1 fig.

357a. WICKENDEN, R. T. D., Some Lower Cretaceous sections on Peace River below the mouth of Smoky River, Alberta: Canada Dept. Mines, Tech. Surv., Geol. Surv. Pap. No. 51-16, 47 pp., 2 pls. (non vidi).

358. YALCINLAR, I., Nouvelles observations sur les terrains paléozoiques des environs d'Istanbul: Geol. Soc. Turkey, Bull., vol. 3, no. 1, pp. 125–130.

YALCINLAR, I., see: CHAPUT, MME. E., and YALCINLAR, I.

359. YOUNG, KEITH, Foraminifera and stratigraphy of the Frontier formation (Upper Cretaceous), southern Montana: Jour. Paleontology, vol. 25, pp. 35–68, pls. 11–14, 6 text figs.

360. ZILCH, JAKOB, Jakob Zinndorf: Natur und Volk, Bericht der Senckenberg. Naturf. Ges. Frankfurt a. M., vol. 81, p. 95.

361. ZINONI, A., L'Oligocene ed il Miocene dei dintorni di Manerba (Lago di Garda): Riv. Ital. Pal. e Strat., vol. 57, pp. 5–19, pls. 1,2.

SUPPLEMENT FOR 1948

362. DONCIEUX, L., Les Foraminifères éocènes et oligocènes de l'ouest de Madagascar: Madagascar, Ann. Geol. Serv. Mines, no. 13, pp. 8–33, 6 pls. (No. 420 for the year 1948).

363. GIANNINI, ENZO, I Foraminiferi del giacimento Calabriano di Vallebiaia (Pisa): Soc. Toscana Sic. Nat., Atti; Mem., vol. 55, pp. 180–227, figs. (non vidi) (No. 421 for the year 1948).

364. RAUZER-CHERNOUSOVA, D. M., and others, Stratigrafia i Foraminifery nizhnego karbona Russkoi Platformy i Priural'ia (in Russian) (Stratigraphy and Foraminifera of the Early Carboniferous of the Russian Platform and the Ural region). (Co-authors: VISSARIONOVA, A. I., GLEBOVSKAJA, E.M., GROZDILOVA, L. P., LIPINA, O. A., SULEIMANOV, I. S., and CHERNYSHEVA, N. E.): Akad. Nauk S.S.S.R., Inst. Geologicheskikh nauk, Trudy, vyp. 62, 1948, pp. 1–262 (No. 422 for the year 1948) (non vidi).

SUPPLEMENT FOR 1949

365. BERTHOIS, L., Sur la présence d'une microfaune dans les calcaires de Santa Maria (Azores): Soc. Afonso Chaves, Bol., vol. 4, 19 pp., 3 pls. (No. 429 for the year 1949).

366. KSIAZKIEWICZ, M., O wieku pstrych margli we Fliszu Karpat zachodnich: Roczn. Bd., 19, h. 2, 1949 (1950) (No. 430 for the year 1949).

367. WOOD, ALAN, The supposed Silurian Foraminifera from Cardiganshire: Geol.Assoc. (London), Proc., vol. 60, pp. 226–228 (No. 431 for the year 1949).

SUPPLEMENT FOR 1950

368. BOLZE, JEAN, Diapirs triasiques et phases orogéniques dans les Monts de Téboursouk (Tunisie septentrionale): Acad. Sci. Paris, Comptes-rendus, tome 231, pp. 480–482 (No. 475 for the year 1950).

369. BOURCART, JACQUES, and LALOU, CLAUDE, Sur la géologie des gorges sous-marines de Toulon: Ibid., Comptes-rendus, tome 230, pp. 1302–1304 (No. 476 for the year 1950).

370. CECHOVIC, V., O geologickom vyvine pot-

karpatskeho miocenu na Sloevensku (Caractère géologique du Miocène subkarpathique de la Slovaquie) (Russian and French summary): Slovenska Akad vied a umeni Bratislava, Geol. Sborn., vol. 1, pp. 204–224 (No. 477 for the year 1950).

371. COLOM, G., Mas allà de la Prehistoria. Una geologia elemental de los Baleares: Consejo Superior Investig. c. c., Cientif. Instituto "San José de Calasanz de Pedagogia," Misiones Pedagogicas, Colleccion Cance No. 5, Madrid, 285 pp., 67 figs., 1 table (No. 478 for the year 1950).

372. DIDKOVSKIJ, V. J. A., (On the microfauna of the Neogene deposits of some regions of the S.S.S.R., Moldavia) (in Ukrainian): Akad. Nauk. S.S.S.R., Doklady 1950, no.2, pp. 113–118 (No. 479 for the year 1950.)

373. FRIZZELL, DON L., Examples of synonymous homonyms: Jour. Paleontology, vol. 24, p. 117 (No. 480 for the year 1950).

374. FURSENKO, A. V., and POLENOVA, E. N., Foraminifery nizhnego volzhskogo iarusa Embenskoi oblasti (raion Inderskogo ozera). (Foraminifera of the lower Volgian Stage in the Emba Oblast' (province) region of Inderskoe Lake): Leningrad, Vsesoinznyi neftianoi nauchno-Isledo-vatel'skii geologo-razvedochnyi Institut. Trudy, no. 49, 1950, pp. 5–92 (No. 481 for the year 1950 (non vidi).

375. GANSS, O., and HILTERMANN, H., Zum Problem des Karpatenflysches (Bukowiec): Deutsche Geol. Ges., Zeitschr., Band 102, 2. Teil 1950 (publ. 31. 10. 1951) pp. 272–286, pls. 7, 8, 3 text figs. (No. 482 for the year 1950).

376. GREIGERT, J., Niger, Soudan: Serv. géol. Afrique occident., française, Rapport annuel, p. 57 (No. 483 for the year 1950).
HILTERMANN, H., see: GANSS, O., and HILTERMANN, H.

377. IJIRI, SHOJI, OGAWA, KENNOSUKE, TAKASAWA, MATSUTSUI and WADA, MAKOTA, Tertiary System in the Chichibu Basin (in Japanese): National Sci. Mus., Bull., No. 28, pp. 1–67, 1 map (No. 484 for the year 1950).

378. JAKOB, K., and SASTRY, M. V. A., On the occurrence of *Globotruncana* in Uttattur Stage of the Trichinopoly Cretaceous, South India: Science and Culture, vol. 16, pp. 266–268, 2 text figs. (No. 485 for the year 1950).

379. KIKOINE, J., Soudan: Serv. géol. Afrique occident. française, Rapport annuel, p. 75 (No. 486 for the year 1950).

380. KREMP, G., Stratigraphische Untersuchungen im Ruhrkarbon mit Hilfe von Mikrofossilien (Mega- und Mikrosporen, Ostracoden, Foraminiferen): "Glückauf," Jahrg. 86, pp. 733–736 (No. 487 for the year 1950).
LALOU, CLAUDE, see: BOURCART, J., and LALOU, C.

381. LIPINA, O. A., Foraminifery verkhnego devona Russkoi platformy (Upper Devonian Foraminifera of the Russian Platform): Akad. Nauk S.S.S.R., Inst. geol. nak Trudy, Moscow no. 119, geol. ser. 43, 1950, 1–132 pp. (No. 488 for the year 1950) (non vidi).

382. LIZAUR Y ROLDAN, J. DE, Nota sobre el flysch eoceno de Beni-Idar (marruecos español): Inst. Geol. Min. España, Notas y Commun, No. 20, pp. 165–171, 15 figs., 1 pl. (No. 489 for the year 1950).

383. MAJZON, LASZLO, Ujalb oslenytani adatok Jpolytarnocrol. (Nouvelles données sur les fossiles du gisement d'Jpolytarnoc): Földt, Közlöny Magyar., vol. 80, pp. 262–264, 1 table (No. 490 for the year 1950).

384. MENNER, V. V., Sovetskaia mikropaleontologira 1930–1949, ditishche stalinskikh piatiletok (Soviet micropaleontology 1930–1949 of the Stalin Five-Year Plans): Moskovskoe Obshchestro Ispytatelei Prirody Biulleten, nov. ser., vol. 121, Otdel. geol. Moscow, vol. 25, no. 2, pp. 24–43 (491 for the year 1950) (non vidi).

385. NEVE, G. A., DE, Subsurface geology of Ampenan West (Lombok) and the Bay of Bima (East Sumbawa): De Ingenieur in Indonesie, 1950, no. 5, pp. iv.17–iv.23, 1 sketch map (No. 492 for the year 1950).
OGAWA, KENNOSUKE, see: IJIRI, S., and others.

386. PANTHY, H., Mikropaleontologicke studium tortonu okalia Sastina. (Étude micropaléontologiques du Tortonien des environs de Sastin): Slovenska Akad. vied a umeni Bratislava, Geol. sbornik, vol. 1, pp. 243–246 (No. 493 for the year 1950) (non vidi).

387. POZARYSKI, W., Les foraminifères éemiens de Tychnowy: Ann. Soc. Géol. Pologne, vol. 20, fasc. 3, Annee 1950 (1951), pp. 311–312 (No. 494 for the year 1950).

388. PREY, S., Geologie des Flyschzone im Gebiete des Perneckar Kogels westlich Kirchdorf an der Krems (Oberösterreich): Jahrb. Geol. Bundesamt., Wien, Bd. 94 (Festband) pp. 93–165, pls. 9, 10, 1 table (No. 495 for the year 1950).

389. PUTRIA, F. S., K stratigrafii miotsenovykh otlozhenii Vostochnykh Karpat: (On stratigraphy of the Miocene deposits in western Karpathians): Moskov. Obshch. Ispyt. Prirod. Biull., n. s., vol. 121, Otd. geol., vol. 25, no. 5, p. 77 ff. (No. 496 for the year 1950 (non vidi).

390. RAUZER-CHERNOUSOVA, D. M., Fatsii verkhne-kamennougol' nykh i artinskikh otlozhenii Sterlitamaksko-Ishimbai'skogo Prural'ic (na osnove izucheniia fuzulinid); (Facies in the Upper Carboniferous and Artinskian deposits Sterlitamak-Ishimbair Pri-Ural'e (based on the study of fusulinids): Akad. nauk S.S.S.R., Inst. geologiche skikh nauk Trudy, Moscow no. 119, geol. ser. 43, 1950 (No. 497 for the year 1950) (non vidi).

391. REITLINGER, E. A., Foraminifery srednekamen-nougolnykh otlozhenii Tsentral'noi chasti Russkoi platformy (iskliuchaia sem. Fusulinidae): Ibid., Moscow, no. 126, geol. ser. no. 47, 127 pp., 22 pls., 15 text figs., 1 table (No. 466 for the year 1950: see: Jour.

Paleontology, vol. 26, no. 2, March 1952, 246, no. 622).

392. RUSCONI, CARLOS, Diferentes organismos del Ordovicio y del Cambrico de Mendoza: Mus. Hist. Nat. Mendoza Rev., vol. 4, no. 3/4, pp. 63–70, illus. (No. 498 for the year 1950.

SASTRY, M. V. A., see: JACOB, K., and SASTRY, M. V. A.

393. SAURIN, E., Les Fusulinidés des calcaires de Ky-Lua Langson (Tonkin): Serv. géol. Indochine, Bull., vol. 29, no. 5, pp. 1–32, 7 pls. (No. 499 for the year 1950).

394. SCHNITTMANN, F. X., Sind die mittleren Freiburger Voralpen (Préalpes Médianes) unterostalpin?: Deutsche Geol. Ges. Zeitschr., Bd. 102, 2. Teil 1950 (31. Oct. 1951), pp. 227–246, 1 text fig. (No. 500 for the year 1950).

395. SCHÜTZNEROVA-HAVELKOVA, V., Mikrofaunisticky vyzkum vrtu Nitkovice ve stredomoravskem helveta (Microfaunistic investigation of the bore at Nitkovice in the Helvetian of Central Moravia: Ceskoslav. Republ., Sborn, stat. geol. odd paleont., vol. 17, pp. 13–99, 1 map, 3 pls., 1 table (Czechoslov., English summary pp. 84–87, Russian summary pp. 82–83) (No. 501 for the year 1950).

396. SEMIKHATOVA, S. V., and KIREEVA, G. D., Fauna moskovskogo iarusa srednego karbona v iuzhnoi chati Dono-Medveditskikh istochnikov (Fauna of the Moscovian stage of the Middle Carboniferous in the southern part of Don-Medveditskii springs: Moskov. Obshch. Ispyt. Prirod, Biull., n. s., vol. 121, Otd. geol., vol. 25, no. 6, pp. 43–58 (No. 502 for the year 1950 (non vidi).

397. SENES, J., Helvetska slirova fauna z okolia Modre ho Kamena (La faune du Schlier Hélvétien des environs de Modry Kame, Slovaquie du Sud): Slvenska Akad. vied umeni Bratislava, Gel. Sborn., vol. 1, pp. 110. 129 (No. 503 for the year 1950).

398. SVAGROVSKY, JOSEF, Strkova formacia pri Varhanov ciach Vych. Slovensko (Les vailloutis de Varhanovce, Slovaquie orientale) (Russian and French summary): Ibid., Geol. sborn, vol. 1, pp. 247–249 (No. 504 for the year 1950).

TAKASAWA, MATSUTSUI, see: IJIRI, S., and others.

399. TUMANSKAIA, O. G., O vysshikh fuzulinidakh iz verkhne-permskikh otlozhenii U.S.S.R. (Higher fusulinids from the Upper Permian deposits of the U.S.S.R.): Moskov. Obshch. Ispyt. Prirod. Biull, n. s., vol. 121, Otd. geol., vol. 25, no. 4, pp. 77–97 (No. 505 for the year 1950) (non vidi).

400. TURNER, J. SELWYN, The Carboniferous limestone in Co. Dublin, south of the river Liffey: Roy. Dublin Soc., Sci. Proc., vol. 25, n. s., no. 13, pp. 169–192, illustr. (No. 506 for the year 1950).

401. VASIČEK, MILOSLAV, Mikropaleontologicky doklad mladotretihorni horotvorne faze na vychnodi Mora ve. (Micropaleontological evidence of the late Tertiary orogenesis in East Moravia.) (With English and Russian summary): Sbornik Stat. geol. ustav., CSR, vol. 17, pp. 1–12, 2 pls—Russian summary p. 6, English summary pp. 7–12 (No. 507 for the year 1950).

402. VASIČEK, MILOSLAV, Zprava o vysledku vrtnych praci v trase oderskodunajskeho pruplavu mezi Bohuminem a Prerovem (Note sur les résultats des sondages exécutés le long tu tracé du canal Oder-Danube entre Bohumin et Prerov): Vestn. Stan. Geol. Ustavu CSR., roc. 25, 1950, pp. 224–225 (Czech. text only) (No. 508 for the year 1950).

403. VASIČEK, M., Zprava o mikropaleontologickych vyzkumech mladsich utvaru (Note sur les recherches micropaléontologiques portant sur les formations récentes): Ibid. roc. 25, 1950, pp. 224–225 (Czech. text only) (No. 509 for the year 1950).

WADA, MAKOTA, see: IJIRI, S., and others.

404. WIRTH, E., Die Erdoelvorkommen von Bruchsal in Baden: Geol. Jahrb. Hannover Bd., 65, pp. 657–706, 6 text figs., 3 tables (No. 510 for the year 1950).

405. WOLBURG, J., Vergleichende stratigraphische Untersuchungen der brackisch-limnischen Ablagerungen Europas an der Wende-Jura-Kreide: Ibid., vol. 64, pp. 159–171, 2 tables (No. 511 for the year 1950).

406. ZINONI, A., Notizie preliminari sull'Oligocene di Manerba (Lago di Gardia): Accad. Nazion. Lincei, Atti., Rendic. cl. fis. mat. nat. (1950), no. 9, pp. 357–360 (No. 512 for the year 1950).

GENERAL INDEX

The numbers refer to publications of the preceding bibliography.

General: 54, 98, 107, 134, 138, 149, 150, 154–156, 169, 170, 183, 185, 197, 243, 244, 273, 279, 285, 286, 300, 305, 336, 338, 339, 384, 401–403.

Activities (News): 23, 24, 37, 50, 53, 67, 70, 81, 100, 116, 130, 157–159, 176, 203, 219, 231, 239, 248, 250, 269, 274, 298, 299, 314–319, 345, 346.

Applied Micropaleontology: 229, 307.

Bathymetry: 28.

Bibliographies: 34, 120, 143, 237, 238, 247, 301, 323–325.

Biographies and Necrologies: 14, 35, 85–88, 147, 148, 160, 184, 218, 233, 360.

Biology: 154–156.

Brackish-Water Foraminifera: 11, 12, 278.

Catalogues and Lists: 18–22, 108–111, 212, 291.

Collections: 195.

Correlation by Foraminifera: 98, 124, 131, 138, 242, 300.

Displacement of Foraminifera: 255, 290.

Distribution of Foraminifera: 16, 28, 82, 124, 131, 227, 229, 230, 256, 285, 309.

Ecology: 197, 225, 228, 234, 255, 256, 264, 279, 355, 377.

Evolution and Phylogeny: 149, 154–156, 283, 285, 305.

Facies: 28, 54, 58–60, 68, 77, 78, 98, 112, 170, 197, 225, 234, 264, 292, 333, 390.

Handbooks: 138, 154, 170, 183, 364.

Methods and Techniques: 26, 36, 57, 61, 113, 123,

149, 162, 175, 182, 201, 202, 215, 221, 259, 275, 280, 340, 355.
Models of Foraminifera: 46, 105, 268.
Monographs: 27, 33, 42, 51, 66, 75, 76, 80, 93, 95, 142, 144, 151–154, 166, 204, 213, 241, 256, 257, 260, 264, 265, 267, 281, 285, 309, 322, 359, 362, 364, 374, 381, 393, 396.
Morphology, Anatomy, wall structure, etc.: 30, 41, 46, 48, 49, 51, 51-a, 51-b, 65, 94, 105, 151–156, 163, 194, 241, 259, 260, 268, 269-a, 275, 282, 285, 287-a, 320, 321.
Paleobiology and Paleoecology: 33, 58–60, 61, 68, 73, 77, 78, 112, 143, 185, 197, 225, 230, 234, 241, 255, 273, 277, 279, 281, 355, 375, 377.
Paleogeography: 33, 131, 241, 285.
Pathology and Teratology: 1, 2.
Problematica: 304, 354, 367.
Reworked Foraminifera: 61, 99, 171, 289, 306, 333, 337, 339, 347, 354, 368.
Sedimentation and Redeposition: 234.
Submarine Occurrences: 44, 55, 56, 73, 240, 258, 369.
Systematics (Taxonomy, Nomenclature): 11, 12, 18–22, 27, 29, 33, 38, 42, 47, 48, 64, 72, 82, 93–95, 134, 135, 144, 151–152-a, 154, 155, 166, 178, 179, 186, 194, 196, 199, 204, 205, 212–214, 221, 241, 245, 257, 260, 262, 264, 265, 267, 269-a, 270, 275, 283, 287-a, 303, 304, 308, 309, 311, 320, 322, 330–332, 341, 356, 359, 362, 364, 373, 374, 381, 392, 393, 396, 399.
Variability: 163.

STRATIGRAPHIC INDEX

Cambrian: 392.
Devonian: 260, 381.
Carboniferous: 45, 62, 82, 83, 145, 181, 182, 202-a, 246, 248, 291, 295, 320, 364, 374, 380, 390, 391, 396, 400.
Permo-Carboniferous: 125, 216, 343-a.
Permian: 211, 221, 288, 313, 320, 326, 364, 390, 393, 399.
Triassic: 309–311, 350, 356, 357.
Liassic: 297, 349.
Jurassic: 40, 90, 92, 172, 310, 349, 356.
Lower Cretaceous: 5, 31, 33, 39, 74, 91, 97, 136, 145, 169, 172, 196, 198, 241, 310–312, 357-a, 394, 405.
Upper Cretaceous: 1, 8, 27, 40, 42, 58–60, 63, 64, 79, 89, 97, 104, 105, 119, 126–128, 136, 137, 145, 146, 153, 163, 172, 174, 177, 188, 193, 194, 200, 210, 220, 222, 223, 241, 242, 251–254, 262, x266, 270–272, 287, 294, 310–312; 322, 326, 328, 329, 337, 343, 354, 378, 388.
Paleocene: 39, 66, 75, 96, 139, 144, 145, 166, 169, 199, 200, 206-a, 210, 229, 254, 265, 287, 294, 326, 388.
Eocene: 3, 4, 15, 17, 38–40, 43, 51-b, 66, 68, 69, 80, 84, 101, 102, 118, 118-a, 121, 124, 129, 132, 133, 145, 161, 166, 172, 187, 193, 206-a, 214, 220, 227, 229, 236, 240, 251, 254, 262, 265, 267, 276, 283, 285, 286, 287-a, 289, 293, 294, 296, 303, 326–329, 335, 339, 341–343, 362, 366, 371, 375, 376, 379, 382, 388.
Oligocene: 2, 7, 10, 17, 38, 41, 44, 68, 71, 93, 94, 99, 124, 129, 140, 165, 172, 187, 190, 192, 206-a, 220, 224, 227, 267, 278, 328, 335, 352, 361, 362, 404, 406.
Oligo-Miocene: 51, 145, 165, 263, 269-a, 383.
Miocene: 6, 17, 40, 41, 47–49, 55, 68, 84, 93, 103, 116, 124, 164, 165, 167, 168, 171, 172, 178, 179, 187, 191, 204, 205, 220, 225–227, 230, 235, 251, 261, 267, 275, 297-a, 302, 308, 326–328, 331, 334, 361, 377, 386, 395, 397, 398, 404.
Pliocene: 13, 61, 62-a, 68, 72, 103, 122, 141, 206, 209, 234, 302, 307, 308, 328, 330, 332.
Pleistocene: 25, 52, 103, 141, 142, 188, 217, 234, 258, 307, 310, 311, 332, 348, 353, 363, 369, 385.
Subrecent: 353.
Recent: 11, 12, 16, 17, 28, 51-a, 68, 115, 141, 142, 151–152-a, 245, 255–257, 281, 290, 347, 353.

GEOGRAPHIC INDEX

AMERICA

Central America: Aruba: 353; *Bermudas:* 114; *Cuba:* 38, 75, 94, 269-a; *Curacao:* 95; *Haiti:* 75; *Jamaica:* 51-a; *Mexico:* 10, 242, 314–317; *Puerto Rico:* 38; *Trinidad:* 41, 42, 47–51, 51-b, 75, 94, 270, 271; *West Indies (in general)*; 50, 75, 93, 95.
North America: Alabama: 161, 327; *Arkansas:* 144, 163; *Alaska:* 309–311; *California:* 16, 27, 56, 72, 73, 103, 121, 166, 209, 234, 251, 254, 287, 290, 318; *Canada:* 127, 357-a; *Colorado:* 45; *Delaware:* 213; *Florida:* 55; *Gulf Coast (in general):* 75, 203, 242; *Louisiana:* 11, 12, 28, 302; *Mississippi:* 38; *Montana:* 359; *New Jersey:* 213, 240; *New Mexico:* 45; *North-Central Region:* 319; *North Carolina:* 213; *Ohio:* 295; *Oregon:* 318; *South Dakota:* 74; *Texas:* 5, 140, 161, 194, 196, 198; *Utah:* 246; *Virginia:* 213; *Washington:* 211, 267, 296, 318; *Wyoming:* 74.
South America: Argentina: 392; *Chile:* 219; *Ecuador:* 76; *Peru:* 298, 299, 303; *Venezuela:* 66, 100, 125, 126, 263, 265, 270, 271, 288, 289, 294.

AFRICA

Abyssinia: 128; *Algeria:* 96, 97, 99, 119, 146, 205, 222–224, 274; *Cameroun:* 199; *Dahomey:* 15; *Egypt:* 283, 328; *French Equatorial Africa:* 200; *Libya:* 84; *Madagascar:* 187, 362; *Morocco:* 274, 297; *Nigeria:* 376; *Senegal:* 199; *Soudan:* 376, 379; *Tunisia:* 274, 368; *Africa (general):* 81.

ASIA

Burma: 229; *India:* 101, 102, 168, 229, 293, 378; *Indochina:* 392; *Iran:* 165, 172; *Israel:* 23–25, 145; *Japan:* 13, 17, 142, 143, 164, 178–180, 221, 225–228, 232, 247–249, 291, 307, 308, 330–332, 351, 377; *Jordan:* 145; *Lebanon:* 145; *Near East (in general):* 37, 145; *Pakistan:* 101, 102, 229, 293; *Syria,* 145; *Turkey:* 9, 39, 40, 62, 80, 104, 116, 173, 216, 312, 322, 326, 329, 358.

EUROPE

Austria: 8, 32, 130, 204, 235, 241, 242, 356, 388; *Belgium:* 118, 345, 346; *Bulgaria:* 297-a *Cyprus:* 145; *Czechoslovakia:* 260–262, 334–339, 370, 386, 395, 397, 398, 401–403; *Denmark:* 53; *France:* 1–3, 60, 62-a, 67, 77–79, 83, 90–92, 105, 118-a, 132, 133, 136, 137, 236, 252, 253, 266, 276, 343; *Germany:* 31–33, 89,

139, 150, 171, 176, 181, 182, 278, 343, 349, 352, 357, 380, 404, 405; *Great Britain:* 61, 82, 250, 306; *Hungary:* 383; *Ireland:* 400; *Italy:* 4, 6, 7, 43, 116, 122, 188–193, 206, 217, 220, 230, 231, 272, 287-a, 341, 342, 361, 363, 406; *Luxembourg:* 345, 346; *Netherlands:* 153, 345–348; *Poland:* 366, 375, 387; *Portugal:* 365; *Russia (incl. Asiatic U.S.S.R.):* 173-a, 202-a, 206-a, 343-a, 364, 372, 374, 381, 384, 389, 390, 396, 399; *Scandinavia:* 53; *Spain (and Baleares):* 63, 64, 68–71, 371, 382; *Sweden:* 52; *Switzerland:* 54, 58, 59, 210, 269, 285, 286, 394; *Yugoslavia:* 177.

OCEANIA

Australia: 124, 313; *Indonesia:* 154, 237–239, 385; *Lombok:* 385; *Misol:* 350; *New Caledonia:* 129; *New Zealand:* 157–159; *Nicobar Islands:* 167; *Philippine Islands:* 174; *South Pacific Islands:* 141; *Sumbawa:* 385; *Timor:* 275.

OCEANS

Atlantic: 44, 55, 255, 258, 281, 347, 348, 369; *Caribbean-Gulf of Mexico:* 115, 255, 256, 257; *Mediterranean:* 245; *Pacific:* 56, 255.

INDEX TO NEW GENERA, SPECIES, AND VARIETIES OF FORAMINIFERA FOR THE YEAR 1951

Note—Number in bold-face type following author's name refers to the index number of publication in preceding bibliography where complete reference is given.

Actinosiphon barbadensis (Vaughan, 1945) forma *caudriae* Cizancourt, **66,** p. 58, pl. 5, figs. 5, 7. Upper lower Eocene, Venezuela.

—— —— —— forma *garapatensis* Cizancourt, **66,** p. 58, pl. 5, figs. 4, 6, 8. Upper lower Eocene, Venezuela.

—— —— —— forma *globulosa* Cizancourt, **66,** p. 58, pl. 5, fig. 3. Upper lower Eocene, Venezuela.

Alabamina cretacea Hofker, **153,** p. 12, text fig. 14. Upper Cretaceous, Senonian, Netherlands.

Allomorphina pacifica Hofker, **154,** p. 139, text fig. 86. Recent, Indonesia, 582 fathoms. (Note: Preoccupied by Cushman and Todd, 1949, Cushman Lab. Foram. Res. Contr., vol. 25, p. 68, pl. 12, figs. 6–9, Pliocene, Fiji; renamed *Allomorphina fragilis* nom. nov. Hofker, 1952, Cushman Found. Foram. Res., Contr., vol. 3, p. 14.)

ALUVIGERINA gen. nov. Hofker, **154,** p. 201. New genus of the family Uvigerinidae. Genotype not properly designated by author; here designated: *Aluvigerina pygmaea* (d'Orbigny) in Hofker, **154,** p. 203, text figs. 132, 133. Recent, Rimini beach sand, Italy.

—— *indonesiae* Hofker, **154,** p. 206, text fig. 134. Recent, Indonesia, 340 and 1015 fathoms.

ALVEOVALVULINA gen. nov. Bronnimann, **48,** p. 100. New genus of family Valvulinidae. Genotype: *Alveovalvulina suteri* Bronnimann, 1951, ut infra. Miocene.

—— *suteri* Bronnimann, **48,** p. 102, pl. 11, fig. 5; text figs. 5–8. Miocene, Trinidad.

Ammobaculites eocretaceus Bartenstein and Brand, **33,** p. 271, pl. 2, figs. 47, 48. Lower Cretaceous (upper Valanginian), N.W. Germany.

—— *irregulariformis* Bartenstein and Brand, **33,** p. 270, pl. 2, figs. 41–44, 46. Lower Cretaceous (upper Valanginian), N.W. Germany.

—— *sthenarus* Tappan, **309,** p. 8, pl. 1, figs. 1–3. Upper Triassic, Alaska.

Ammovertella cellensis Bartenstein and Brand, **33,** p. 267, pl. 1, figs. 18–22; pl. 13, fig. 359. Lower Cretaceous (upper Valanginian), N.W. Germany.

Amphistegina angulata (Cushman, 1919) var. *christmani* Drooger, **93,** p. 62, text fig. 3. Lower Miocene, St. Martin, Leeward Islands.

—— *schoefflleri* Cizancourt, **66,** p. 59, pl. 4, figs. 20, 21; pl. 5, figs. 13, 19. Paleocene, Barbados and Venezuela.

Angulogerina bella Phleger and F. L. Parker, **257,** p. 12, pl. 6, figs. 7, 8. Recent, N.W. Gulf of Mexico, 91 meters.

Anomalina asanoi Murata, **225,** p. 96, pl. 1, fig. 3. Miocene, Japan.

—— *bighornensis* Young, **359,** p. 66, pl. 14, figs. 17–22. Upper Cretaceous, Montana, U.S.A.

—— *toddae* Harris and Jobe, **144,** p. 51, pl. 10, figs. 8, 9. Paleocene, Arkansas, U.S.A.

ARENONIONELLA gen. nov. Marks, **205,** p. 377. New genus of family Lituolidae, subfamily Haplophragmiinae. Genotype: *Arenonionella voutei* Marks, 1951, ut infra. Miocene.

—— *voutei* Marks, **205,** p. 378, text figs. 1–4. Miocene, Algeria.

ARENOPARRELLA gen. nov. Andersen, **12,** p. 31. New genus of family Trochamminidae. Genotype: *Trochammina inflata* (Montagu, 1808), var. *mexicana* Kornfeld, 1931, Contr. Stanford Univ., Geol. Dept., vol. 1, p. 86, pl. 13, fig. 5. Recent (brackish water).

Articulina sulcata Reuss, 1850, var. *nuda* Marks, **204,** p. 37, pl. 5, fig. 8. Middle Miocene, Vienna Basin, Austria.

Assilina reicheli Schaub, **286,** p. 215, text figs. 333, 334; pl. 9, figs. 25–27. Uppermost Ypresian, Switzerland.

Astacolus connudatus Tappan, **309,** p. 10, pl. 2, figs. 8–19. Upper Triassic, Alaska.

Asterigerina tatumi Hussey, **161,** p. 19, pl. 3, figs. 1–3. Lower Claiborne, Eocene, Alabama, U.S.A.

ASTEROROTALIA gen. nov. Hofker, **154,** p. 502. New genus of family Rotaliidae. Genotype (not properly designated by author): *Asterorotalia pulchella* (d'Orbigny) in Hofker, **154,** p. 505, text figs. 343, 344. Recent, Indonesia. Recent.

Bermudezina bramlettei Israelsky, **166,** p. 19, pl. 7, figs. 18–24. Paleocene-Eocene (Lodo formation), California, U.S.A.

—— *extans* Bandy, **27,** p. 492, pl. 72, fig. 2. Upper Cretaceous (Campanian), California, U.S.A.

Bifarina decorata Phleger and F. L. Parker, **257,** p. 12, pl. 6, figs. 9, 10. Recent, N.W. Gulf of Mexico, 51 meters. (Note: In footnote on p. 12 this species is placed in synonymy with *"Siphogenenina"ad vena* Cushman, 1922, Car-

negie Inst. Washington, Publ. 311, vol. 17, p. 35, pl. 5, fig. 2.) (It is probably a *Rectobolivina*.)
Biforaminata new sub-order Hofker, **154,** p. 306. New suborder of order Dentata Hofker, 1951, ut infra. Comprises the families Ceratobuliminidae. Cibicididae, Eponididae. Epistominidae, Robertinidae, Camerinidae (recte Nummulitidae), Laticarininidae and Alabaminidae.
Bigenerina antiquissima Bartenstein and Brand, **33,** p. 275, pl 3, figs. 73, 74. Lower Cretaecous (upper Valanginian), N.W. Germany.
—— *irregularis* Phleger, and F. L. Parker, **257,** p. 4, pl. 1, figs. 16–21. Recent, N.W. Gulf of Mexico, 57 meters.
BISACCIUM gen. nov. Andersen, **12,** p. 32, New genus of Nonionidae (a fam. nov.?). Genotype: *Bisaccium imbricatum* Andersen, 1951, ut infra. Recent, (brackish water).
—— *imbricatum* Andersen, **12,** p. 32, text fig. 2. Recent, Louisiana, brackish water.
Bolivina asanoi Uchio, **331,** p. 373, fig. 10. Middle Miocene, Japan.
—— *barbata* Phleger and F. L. Parker, **257,**. p. 13, pl. 6, figs. 12, 13. Recent, Gulf of Mexico.
—— *crassiseptata* Marks, **204,** p. 59, pl. 7, fig. 18. Middle Miocene, Austria.
—— *fragilis* Phleger and F. L. Parker, **257,** p. 13, pl. 6, figs. 14, 23, 24. Recent, N.W. Gulf of Mexico.
—— *hastata* Phleger and F. L. Parker, **257,** p. 13, pl. 6, figs. 18, 19. Recent, N.W. Gulf of Mexico.
—— *lathetica* Tappan, **309,** p. 16, pl. 5, figs. 17–19. Upper Triassic, Alaska.
—— *lowmani* Phleger and F. L. Parker, **257,** p. 13, pl. 6, figs. 20, 21. Recent, N.W. Gulf of Mexico.
—— *minima* Phleger and F. L. Parker, **257,** p. 14, pl. 6, figs. 22, 25; pl. 7, figs. 1, 2. Recent, N.W. Gulf of Mexico.
—— *otukai* Uchio, **332,** p. 35, pl. 3, fig. 7. Upper Pliocene, Japan.
—— *ramosa* Hofker, **154,** p. 52, text fig. 21. Recent, Indonesia, 928 fathoms.
—— *simplex* Phleger and F. L. Parker, **257,** p. 14, pl. 7, figs. 4–6. Recent, N.W. Gulf of Mexico. (Note: Preoccupied by Cushman and H. H. Renz, 1941, Cushman Lab. Foram. Res. Contr., vol. 17, p. 20, pl. 3, fig. 15. Miocene, Venezuela, and therefore renamed *Bolivina ordinaria* Phleger and F. L. Parker, 1952, Cushman Found. Foram. Res., Contr., vol. 3, p. 14.)
—— *trajectina* Marks, **204,** p. 60, pl. 7, fig. 3. Middle Miocene, Austria.
—— *translucens* Phleger and F. L. Parker, **257,** p. 15, pl. 7, figs. 13, 14. Recent, N.W. Gulf of Mexico.
—— *viennensis* Marks, **204,** p. 60, pl. 7, figs. 1, 2. Middle Miocene, Austria.
Bolivinella pendula Harris and Jobe, **144,** p. 39, pl. 7, fig. 17. Paleocene, Arkansas, U.S.A.
Bontourina saturniformis Cizancourt, **66,** p. 55, pl. 5, fig. 18; pl. 6, figs. 25–28, 31, 32. Paleocene, Venezuela.
BRAMLETTEIA subgen. nov. Israelsky, **166,** p. 10. New subgenus of *Silicosigmoilina* Cushman and Church, 1929. Family Silicinidae, subfamily Rzehakininae. Sub-genotype, *Silicosigmoilina* (*Bramletteia*) *perplexa* Israelsky, 1951, ut infra. Paleocene-Eocene.
—— see: *Silicosigmoilina*.
Bulimina affectata Cushman and Stainforth, **76,** p. 154, pl. 26, fig. 40, 41. Upper Eocene, Ecuador.
—— *bulletella* Young, **359,** p. 64, pl. 13, figs. 15–18. Upper Cretaceous, Montana, U.S.A.
—— *spicata* Phleger and F. L. Parker, **257,** p. 16, pl. 7, figs. 25, 30, 31. Recent, N.W. Gulf of Mexico.
—— *tenuis* Phleger and F. L. Parker, **257,** p. 16, pl. 7, figs. 33, 34. Recent, N.W. Gulf of Mexico, 59 meters.
Buliminella loeblichi Bartenstein and Brand, **33,** p. 324, p. 13, figs. 368–369. Lower Cretaceous (upper Valanginian), N.W. Germany.
—— *peruviana* Cushman and Stone, 1947, var. *obesa* Cushman and Stainforth, **76,** p. 151, pl. 26, fig. 35. Upper Eocene, Ecuador.
CASSIDELLA gen. nov. Hofker, **153,** p. 264. New genus of family Cassidulinidae. Genotype: "*Virgulina* (*Bolivina*) *tegulata* (Reuss)" in Hofker, 1951, **153,** p. 265, text fig. 175. Cretaceous to Miocene; Recent.
—— *oligocenica* Hofker, **153,** p. 265, text fig. 176. Oligocene, Netherlands.
—— *pacifica* Hofker, **153,** p. 273, text fig. 181. Recent reefs, Indonesia. For: *Virgulina complanata* Cushman, 1937 (non Egger, 1893), Cushman Lab. Foram. Res., Spec. Publ. No. 9, pl. 4, figs. 14, 15, 17; and for same species in Cushman, 1942, U. S. Nat. Museum, Bull. 161, pt. 3, pl. 4; figs. 2–4.
Cassidulina cruysi Marks, **204,** p. 68, pl. 8, figs. 3, 4. Middle Miocene, Austria.
—— *curvata* Phleger and F. L. Parker, **27,** p. 26, pl. 14, fig. 5. Recent, N.W. Gulf of Mexico.
—— *norcrossi* Cushman, 1933, var. *australis* Phleger and F. L. Parker, **257,** p. 27, pl. 14, figs. 8–10. Recent, N.W. Gulf of Mexico.
—— *teretis* Tappan, **311,** p. 7, pl. 1, fig. 30. Pleistocene, Alaska.
—— *tomiyensis* Uchio, **332,** p. 40, pl. 3, fig. 3. Upper Pliocene, Japan.
Cassidulinoides tenuis Phleger and F. L. Parker, **257,** p. 27, pl. 14, figs. 15–17. Recent, N.W. Gulf of Mexico.
Chrysalogonium arkansasanum Cushman and Todd, 1946, var. *minima* Harris and Jobe, **144,** p. 24, pl. 4, fig. 19. Paleocene, Arkansas, U.S.A.
Cibicides deprimus Phleger and F. L. Parker, **257,** p. 29, pl. 15, figs. 16, 17. Recent, N.W. Gulf of Mexico. For: *?Cibicides pseudoungerianus* (Cushman) var. *io* Cushman, 1931, U. S. Nat. Mus., Bull. 104, pt. 8, p. 125, pl. 23, fig. 2 (non fig. 1).
—— *equipunctata* Hofker, **154,** p. 362, text figs. 246, 247. Recent, Indonesia, 320–377 fathoms.
—— *hyalina* Hofker, **154,** p. 359, text figs. 244, 245. Recent, off southern Sumatra, Indonesia, 200–700 fathoms.
—— *joycei* Harris and Jobe, **144,** p. 52, pl. 10, figs. 14, 15. Paleocene, Arkansas, U.S.A.
—— *kamadai* Asano, **20,** p. 17, figs. 33–35. Oligocene, Japan.

—— *kennedyi* Young, **359,** p. 66, pl. 14, figs. 27–29. Upper Cretaceous, Montana, U.S.A.
—— *mollis* Phleger and F. L. Parker, **257,** p. 30, pl. 16, figs. 7–9. Recent, N.W. Gulf of Mexico.
—— *robustus* Phleger and F. L. Parker, **257,** p. 31, pl. 17, figs. 1–4. Recent, N.W. Gulf of Mexico, 157 meters. (Note: Preoccupied by Y. LeCalvez, 1949, Mém. Explicat. Carte géol dét. France, p. 47, pl. 4, figs. 57–59. Lutetian, France, and, therefore, renamed: *Cibicides corpulentus nom. nov.* Phleger and F. L. Parker, 1952, Cushman Found. Foram. Res., Contr., vol. 3, p. 14.
—— *rugosus* Phleger and F. L. Parker, **257,** p. 31, pl. 17, figs. 5, 6. Recent, N.W. Gulf of Mexico, 914 meters.
—— *umbonatus* Phleger and F. L. Parker, **257,** p. 31, pl. 17, figs. 7–9. Recent, N.W. Gulf of Mexico.
Cibicidina californica Bandy, **27,** p. 505, pl. 74, fig. 7. Upper Cretaceous (Campanian), California, U.S.A.
Cibicidoides cederstromi McLean, **213,** p. 28, pl. 4, figs. 12–14. Paleocene, New Jersey, U.S.A.
Citharina pseudostriatula Bartenstein and Brand, **33,** p. 298, pl. 7, fig. 182; pl. 12-A, fig. 339. Lower Cretaceous (middle Valanginian), N.W. Germany. For: *Vaginulina harpa* Roemer in Kasanzev, 1936, Mit. Geol. Erdöl.-Inst. Leningrad, ser. A, No. 56, p. 19, pl. 3, fig. 38; and for same species in Bartenstein and Brand 1937, Senckenberg, Naturf. Ges. Abhandl. No. 439, p. 163, p.. 14-B, fig. 7.
—— *rudocostata* Bartenstein and Brand, **33,** p. 299, pl. 7, fig. 183; pl. 12-A, fig. 340. Lower Cretaceous (middle Valanginian), N.W. Germany. For: *Vaginulina harpa* Roemer in Macfadyen, 1935, Geol. and Palaeont. Somaliland, pt. 2, p. 12, pl. 1, fig. 18; and for same species in: Kasanzev, 1936, Mitt. Geol. Erdöl-Inst. Leningrad, ser. A., No. 56, p. 19, pl. 3, fig. 40.
—— *seitzi* Bartenstein and Brand, **33,** p. 296, pl. 7, figs. 171, 172. Lower Cretaceous (upper Valanginian), N.W. Germany. For: *Vaginulina* sp. Kasanzev, 1936, Mitt. Geol. Erdöl-Inst. Leningrad, ser. A., No. 56, p. 20, pl. 3, fig. 41; and for: *Vaginulina D-27* and *D-35* in Hecht, 1938, Senckenberg. Naturf. Ges. Abhandl., No. 443, pl. 19-A, figs. 87–90, and pl. 24, fig. 131.
Clavulinoides inflatus Israelsky, **166,** p. 20, pl. 8, figs. 9–15. Paleocene-Eocene (Lodo formation), California, U.S.A.
Colomia californica Bandy, **27,** p. 512, p. 75, fig. 11. Upper Cretaceous (Campanian), California, U.S.A.
—— —— —— var. *mundula* Bandy, **27,** p. 512, pl. 75, fig. 12. Upper Cretaceous (Campanian), California, U.S.A.
CONORBELLA gen. nov. Hofker, **154,** p. 466. New genus of family "Pulvinulinidae" of Hofker. Genotype (not properly designated): *Conorbella pulvinata* (Brady) in Hofker, 1951, **154,** p. 470, text fig. 320. Recent, off Chile, Pacific Ocean. Occurrence: not stated, apparently Recent.
Conorbidae fam. nov. Hofker, **154,** p. 414. Includes *Conorbis* Hofker, 1951, ut infra, and *Discobolivina* Hofker, 1951, ut infra. Jurassic to Recent (see note under *Conorbis* Hofker, 1951, ut infra).
CONORBIS, gen. nov. Hofker, **154,** p. 418, New genus of family Conorbidae Hofker, 1951, ut supra. Genotype: *Conorbis mitra* Hofker, 1951, ut infra. (Note: Genus name is preoccupied by Swainson, 1840, Treat. Malacol., p. 149 and 312, for a Molluscan genus, and has, therefore, been renamed: *CONORBOIDES* nom. nov. Hofker, 1952, in Thalmann, 1952, Cushman Found., Foram. Res., Contr., vol. 3, p. 14. The new family Conorbidae, ut supra, should be changed accordingly to Conorboididae.)
—— *hofkeri* Bartenstein and Brand, **33,** p. 325, pl. 11, fig. 320. Lower Cretaceous (upper Valanginian), N.W. Germany. (Note: This new species has now to be assigned to the genus *Conorboides* Hofker, 1952.)
—— *mitra* Hofker, **154,** p. 418, text fig. 286. Lower Cretaceous, Netherlands.
—— *valendisensis* Bartenstein and Brand, **33,** p. 326, p. 11, figs. 321, 322, 342, 343. Lower Cretaceous (middle Valanginian), N.W. Germany. (Note: This species has to be allocated to the genus *Conorboides* Hofker, 1952.)
? Cornuspira primitiva Bartenstein and Brand, **33,** p. 279, pl. 4, fig. 90. Lower Cretaceous (upper Valanginian), N.W. Germany. (Note: Preoccupied by Rhumbler, 1903, Arch. Protistenk., vol. 3, p. 285, text fig. 136; will be renamed: *? C. subprimitiva nom. nov.*, according to letter received from authors, April 1, 1952.)
Cornuspiroides oinomikadoi Hanzawa and Asano, **20,** p. 1, fig. 2. Oligocene, Japan.
—— *yabei* Asano, **20,** p. 2, figs. 3, 4. Pliocene, Japan.
Cribroelphidium arcticum Tappan, **311,** p. 6, pl. 1, figs. 27, 28. Pleistocene, Alaska.
Cyclammina ezoensis Asano, **20,** p. 5, figs. 16, 17. Miocene, Japan.
—— *polygonata* Noth, **241,** p. 32, pl. 6, fig. 16. Upper Cretaceous (Senonian), Austria.
Dendritina striata Hofker, **151,** p. 234, text figs. 12–14. Recent, off Borneo, Indonesia.
—— *striato-punctata* Hofker, **151,** p. 233, text figs. 10, 11. Recent, Indonesia.
Dentalina annloomisae McLean, **213,** p. 25, pl. 4, figs. 6. 7. Paleocene New Jersey, U.S.A. For: *Dentalina sp.* Cushman, 1940, Cushman Lab. Foram. Res., Contr., vol. 16, p. 58, pl. 10, figs. 20, 21. Paleocene, Alabama, U.S.A.
—— *porcatulata* Loeblich and Tappan, **196,** p. 88, pl. 2, figs. 15, 16. Lower Cretaceous, Texas, U.S.A.
Dentata ordo nov. Hofker, **154,** p. 14. New order of the Foraminifera. Includes the following new suborders: Protoforaminata Hofker, 1951, ut infra; Biforaminata Hofker, 1951, ut supra; and Deuteroforaminata Hofker, 1951, ut infra.
Deuteroforaminata subordo nov. Hofker, 1951, **154,** p. 412. New suborder of the order Dentata Hofker, 1951, ut supra. Includes the families: Conorboididae, Amphisteginidae, Cymbaloporettidae, Tinoporidae, Rotaliidae, Pulvinulinidae of Hofker, Marginolamellidae, Valvulineridae, and Globigerinidae.
DISCAMMINOIDES gen. nov. Bronnimann, **48,** p. 103. New genus of family Lituolidae,

subfamily Lituolinae. Genotype: *Discamminoides tobleri* Bronnimann, 1951, ut infra. Miocene.
—— *tobleri* Bronnimann, **48,** p. 103, pl. 9, fig. 7; text figs. 9–12. Miocene, Trinidad.
DISCANOMALINA gen. nov. Asano, **20,** p. 13. New genus of family Anomalinidae. Genotype: *Discanomalina japonica* Asano, 1951, ut infra. Pliocene to Recent.
—— *japonica* Asano, **20,** p. 13, figs. 3–5. Pliocene, Japan.
DISCOBOLIVINA gen. nov. Hofker, **154,** p. 422. New genus of family Conorbidae (*recte* Conorboididae). Genotype: not stated, here designated: *Discobolivina conica* (Heron-Allen and Earland) in Hofker, 1951, **154,** p. 425, text. figs. 290–292. ?Jurassic, Cretaceous to Recent.
—— *nitida* Hofker, **154,** p. 428, text figs. 293, 294. Recent, off southern Sumatra, 222–683 fathoms.
Discocyclina (*Discocyclina*) *evremondi* Cizancourt, **66,** p. 63, pl. 5, figs. 1, 2. Upper lower Eocene, Venezuela.
—— (——) *vautrini* Cizancourt, **66,** p. 52, pl. 5, figs. 17, 21. Upper lower Eocene, Venezuela.
DISCOPULVINULINA gen. nov. Hofker, **154,** p. 448. New genus of family "Pulvinulinidae" of Hofker. Genotype: not properly designated by author, given as "*Discopulvinulina bertheloti* (d'Orbigny)." Upper Cretaceous to Recent.
—— *hofkeri* Asano, **21,** p. 5, text figs. 30, 31. Pliocene, Japan.
—— *hyalina* Hofker, **154,** p. 466, text figs. 318, 319. Recent, Indonesia, 43–377 fathoms.
—— *macropora* Hofker, **154,** p. 460, text figs. 312, 313. Recent, Bay of Naples, Italy.
—— *nagaoi* Asano, **21,** p. 5, figs. 35–37, Pliocene, Japan.
—— *pacifica* Hofker, **154,** p. 452, text figs. 307–309. Recent, Indonesia, 222 fathoms.
—— *pseudolobatula* Hofker, **154,** p. 462, text figs. 314–317. Recent, Indonesia, 43 fathoms.
—— *stachi* Asano, **21,** p. 7, figs. 46–48. Pliocene, Japan.
Discorbis magna Vialli, **341,** p. 23, fig. 3. Upper Lutetian, Italy. (Note: same species also described as new by Vialli, **342,** p. 152, text fig. 2 but from lower Lutetian, northern Italy.)
—— *nakamurai* Asano, **21,** p. 2, figs. 8–10. Pliocene, Japan.
—— *ozawai* Asano, **21,** p. 3, figs. 14–16. Pliocene, Japan.
—— *pristina* Tappan, **309,** p. 16, pl. 5, figs. 23–25. Upper Triassic, Alaska.
—— *stictata* Tappan, **311,** p. 4, pl. 1, fig. 18. Lower Cretaceous, Alaska.
—— *subopercularis* Asano, **21,** p. 3, text figs. 17–19. Pliocene, Japan.
Dorothia altacamerata Israelsky, **166,** p. 24, pl. 10, figs. 3–6; pl. 11, figs. 1–3. Paleocene-Eocene (Lodo formation), California, U.S.A.
—— *bulbosa* Israelsky, **166,** p. 23, pl. 9, figs. 33–35; pl. 11, fig. 17. Paleocene-Eocene (Lodo formation), California, U.S.A.
—— *excentrica* Israelsky, **166,** p. 22, pl. 9, figs. 22–26; pl. 11, figs. 18–24. Paleocene-Eocene (Lodo formation), California, U.S.A.
—— *soapcreekensis* Young, **359,** p. 49, pl. 11, figs. 3–6. Upper Cretaceous, Montana, U.S.A.
—— *subretusa* Israelsky, **166,** p. 23, pl. 9, figs. 36–38; pl. 11, figs. 4, 5. Paleocene-Eocene (Lodo formation), California. U.S.A.
Eggerella balanitis Harris and Jobe, **144,** p. 11, pl. 2, fig. 10. Paleocene, Arkansas, U.S.A.
—— *jobei* Harris and Jobe, **144,** p. 11, pl. 2, fig. 11. Paleocene, Arkansas, U.S.A.
Ehrenbergina bosoensis Takayanagi, **308,** p. 87, text fig. 8. Pliocene, Japan.
—— —— —— subsp. *decorata* Takayanagi, **308,** p. 89, text fig. 9. Pliocene, Japan.
—— *notoensis* Asano, **19,** p. 6, figs. 29, 30. Miocene, Japan.
Elphidiella momiyamensis Uchio, **331,** p. 372, fig. 7. Middle Miocene, Japan.
Elphidium flexuosum (d'Orbigny, 1846) var. *reussi* Marks, **204,** p. 52, pl. 6, fig. 7. Middle Miocene, Austria. For: *Polystomella flexuosa* Reuss, 1850 (non d'Orbigny, 1846), Denkschr. k. Akad. Wiss. Wien, vol. I, p. 370, pl. 48, fig. 3.
—— *gunteri* Cole, 1931, var. *waddensis* Voorthuysen, **347,** p. 25, pl. 2, fig. 16. Recent, off Netherlands, tidal flats.
—— *ozawai* Uchio, **331,** p. 372, fig. 11. Upper Miocene, Japan.
Entosolenia circulo-costa (Asano, 1938), var. *carinata* Uchio, **332,** p. 37, pl. 3, fig. 11. Plio-Pleistocene, Japan.
—— *marginata* (Walker and Boys, 1784) var. *angulata* Uchio, **332,** p. 38, pl. 3, fig. 14. Upper Pliocene, Japan. For: *Lagena marginata* Walker and Boys var. in Cushman, 1933, U. S. Nat. Mus. Bull. 161, p. 17, pl. 4, fig. 11.
—— —— (——) var. *cushmani* Uchio, **332,** p. 37, pl. 3, fig. 13. Upper Pliocene, Japan. For: *Lagena marginata* Walker and Boys var. in Cushman, 1933, U. S. Nat. Mus. Bull., 161, p. 17, pl. 4, fig. 14.
—— *ozawai* Uchio, **332,** p. 37, pl. 3, fig. 10. Upper Pliocene, Japan.
Eoeponidella strombodes Tappan, **311,** p. 6, pl. 1, fig. 22. Upper Cretaceous, Alaska.
Eoguttulina bulgella Tappan, **309,** p. 14, pl. 4, figs. 23, 24, Upper Triassic, Alaska.
Epistomina caracolla (Roemer, 1841) subsp. *anterior* Bartenstein and Brand, **33,** p. 326, pl. 12-A, fig. 341. Lower Cretaceous (Valanginian), N.W. Germany.
—— *praeornata* Bartenstein and Brand, **33,** p. 327, pl. 12–A, fig. 326. Lower Cretaceous (upper Valanginian), N.W. Germany.
—— *tenuicostata* Bartenstein and Brand, **33,** p. 327, pl. 12-A, fig. 325. Lower Cretaceous (upper Valanginian), N.W. Germany.
Eponides hannai Phleger and F. L. Parker, **257,** p. 21, pl. 10, figs. 11–14. Recent, N.W. Gulf of Mexico, 35 meters.
—— *midwayensis* Harris and Jobe, **144,** p. 47, pl. 9, figs. 3, 6. Paleocene, Arkansas, U.S.A. For: *Truncatulina tenera* Brady in Plummer, 1926, Univ. Texas Bull. 2644, p. 146, pl. 9, fig. 5; for: *Eponides sp.* Cushman, 1940, Cushman Lab. Foram. Res., Contr., vol. 16, p. 71. pl. 12, fig. 8; for: *Eponides* cf. *tenera* Kline, 1943, Mississippi State Geol. Surv., Bull. 53, p. 53, pl. 5, figs. 16, 18; and for *Eponides* cf.

haidingeri Cushman and Todd, 1946, Cushman Lab. Foram. Res., Contr., vol. 22, p. 62, pl. 11, figs. 5, 6.
—— *polius* Phleger and F. L. Parker, **257,** p. 21, pl. 11, figs. 1, 2. Recent, N.W. Gulf of Mexico.
—— *regularis* Phleger and F. L. Parker, **257,** p. 21, pl. 11, figs. 3, 4. Recent, N.W. Gulf of Mexico.
—— *subpraecinctus* Asano, **21,** p. 12, figs. 88–90. Pliocene, Japan.
—— *tanai* Uchio, **331,** p. 376, figs. 8, 9. Middle Miocene, Japan.
—— *turgidus* Phleger and F. L. Parker, **257,** p. 22, pl. 11, fig. 9. Recent, N.W. Gulf of Mexico.
EUUVIGERINA gen. nov. Hofker, **154,** p. 217. New genus of the family Uvigerinidae. (Note: cave *Eouvigerina* Cushman, 1926!). Genotype: not designated by Hofker, here designated as *Euuvigerina aculeata* (d'Orbigny) in Hofker, loc. cit., p. 226, text figs. 150–154, including *Uvigerina aculeata* d'Orbigny, 1846, Foram. Foss. Bas. Tert. Vienne, p. 191, pl. 11, figs. 27, 28; same species in Cushman, 1913, U. S. Nat. Mus. Bull. 71, pt. 3, p. 100, pl. 43, fig. 4; *Uvigerina schwageri* Brady, 1884, Rept. Voyage Challenger, Zool., vol. 9, p. 573, pl. 74, figs. 8–10, and same species in Cushman, 1913, loc. cit., Bull. 71, pt. 3, p. 97, pl. 37, figs. 3, 4. Tertiary to Recent.
Flabellammina fredericksoni Harris and Jobe, **144,** p. 6, pl. 1, fig. 9. Paleocene, Arkansas, U.S.A.
—— *stadthageni* Bartenstein and Brand, **33,** p. 269, pl. 1, figs. 27, 28. Lower Cretaceous (transition upper Valanginian to lower Hauterivian), N.W. Germany.
Flintina droogeri Marks, **204,** p. 41, pl. 5, figs. 2, 3. Middle Miocene, Austria.
Frankeina fundibularis Harris and Jobe, **144,** p. 7, pl. 1, fig. 8. Paleocene, Arkansas, U.S.A.
Frondicularia acmaea Tappan, **309,** p. 13, pl. 4, figs. 1–4. Upper Triassic, Alaska.
—— *frankei* Cushman, 1936, var. *costata* Harris and Jobe, **144,** p. 29, pl. 6, fig. 2. Paleocene, Arkansas, U.S.A. (Note: Preoccupied by Kübler and Zwingi, 1866, Neujahrsbl. Bürgersbibliothek Winterthur, p. 8, pl. 1, fig. 1, and, therefore, will be changed to *Frondicularia surfibrata* nom. nov., according to a letter from the authors, June 16, 1952.)
—— *frontierensis* Young, **359,** p. 61, pl. 13, figs. 1–3. Upper Cretaceous, Montana, U.S.A.
—— *hastata* Roemer, 1842, subsp. *paucicostulata* Bartenstein and Brand, **33,** p. 305, pl. 9, fig. 216. Lower Cretaceous (upper Valanginian), N.W. Germany.
—— *imbricata* Young, **359,** p. 61, pl. 13, figs. 4–6. Upper Cretaceous, Montana, U.S.A.
—— *lustrata* Tappan, **311,** p. 2, pl. 1, figs. 3, 4. Lower Jurassic, Alaska.
—— *microdisca* Reuss, 1860, var. *dichotomiana* Bartenstein and Brand, **33,** p. 304, pl. 8, fig. 204. Lower Cretaceous (upper Valanginian), N.W. Germany.
—— *pseudoconcinna* Bartenstein and Brand, **33,** p. 306, pl. 9, figs. 213–215. Lower Cretaceous (upper Valanginian), N.W. Germany.
—— *rehburgensis* Bartenstein and Brand, **33,** p. 305, pl. 8, fig. 211. Lower Cretaceous (upper Valanginian), N.W. Germany.
—— *richardsi* McLean, **213,** p. 26, pl. 4, fig. 11, Paleocene, North Carolina, U.S.A.
FUSARCHAIAS gen. nov. Reichel, **269-a,** p. 459. New genus of family Peneroplidae. Genotype: *Fusarchaias bermudezi* Reichel, 1951, ut infra. Oligo-Miocene.
—— *bermudezi,* Reichel, **269-a,** p. 460, text figs. 1–5. Oligo-Miocene, Cuba.
Gaudryina adoxa Tappan, **309,** p. 9, pl. 2, figs. 5–7. Upper Triassic, Alaska.
—— *arguta* Bandy, **27,** p. 492, pl. 72, fig. 3. Upper Cretaceous (Campanian), California, U.S.A.
—— (*Gaudryina*) *expansa* Israelsky, **166,** p. 16, pl. 5, figs. 21–24. Paleocene-Eocene (Lodo formation), California, U.S.A.
—— (——) *inflata* Israelsky, **166,** p. 16, pl. 6, figs. 1–12. Paleocene-Eocene (Lodo formation), California, U.S.A.
—— *nanushukensis* Tappan, **311,** p. 2, pl. 1, figs. 8–11. Lower Cretaceous, Alaska.
—— *tsuchidai* Uchio, **331,** p. 369, fig. 3. Middle Miocene, Japan.
—— *vetustissima* Bartenstein and Brand, **33,** p. 276, pl. 12-A, fig. 335. Lower Cretaceous (upper Valanginian), N.W. Germany.
—— (*Pseudogaudryina*) *coalingensis* Cushman and G. D. Hanna, 1927, var. *alata* Israelsky **166,** p. 17, pl. 6, figs. 23–27. Paleocene-Eocene (Lodo formation), California, U.S.A.
—— (——) *corrugata* Israelsky, **166,** p. 18, pl. 7, figs. 13–17. Paleocene-Eocene (Lodo formation), California, U.S.A.
—— (——) *phenocrysta* Israelsky, **166,** p. 18, pl. 7, figs. 1–4. Paleocene-Eocene (Lodo formation), California, U.S.A.
—— (——) *pyramidata* (Cushman, 1926) subsp. *tumeyensis* Israelsky, **166,** p. 18, p. 7, figs. 5–12. Paleocene-Eocene (Lodo formation), California, U.S.A.
Gaudryinella hannoverana Bartenstein and Brand, **33,** p. 276, pl. 4, fig. 78; pl. 12-A, figs. 328, 329. Lower Cretaceous (upper Valanginian), N.W. Germany.
Gavelinella gyroidiniformis Hofker, **153,** p. 24, text fig. 29. Upper Cretaceous (upper Senonian), Netherlands.
GAVELINOPSIS gen. nov. Hofker, **154,** p. 485. New genus of family Valvulineridae. Genotype (not properly designated): *Gavelinopsis praegeri* (Heron-Allen and Earland) in Hofker, loc. cit., p. 486, text figs. 332–334. Recent.
Glandulina nipponica Asano, **21,** p. 14, figs. 71, 72. Pliocene, Japan.
GLOBIGERINITA gen. nov. Bronnimann, **47,** p. 18. New genus of family Globigerinidae. Genotype: *Globigerinita naparimaensis* Bronnimann, 1951, ut infra. Lower Miocene, probably also upper Oligocene.
—— *naparimaensis* Bronnimann, **47,** p. 18, text figs. 1–14. Lower Miocene, Trinidad.
Globobulimininae new subfam. Hofker, **154,** p. 248. Includes the genera: *Globobulimina* Cushman, 1927; *Praeglobobulimina* Hofker, 1951, ut infra; and *Protoglobobulimina* Hofker, 1951, ut infra.

Globotruncana citae Bolli, **42,** p. 197, pl. 35, figs. 4–6. Upper Cretaceous (Maestrichtian), Trinidad.
—— *conica-caliciformis* nom. nov. Tilev. **322,** p. 71, pl. 3, fig. 6. Upper Cretaceous (Maestrichtian), France and Turkey. New name for: *Globotruncana conica* White, 1928, Jour. Paleontology, vol. 2, p. 285, pl. 38, fig. 7; for: *Globotruncana conica* White var. *plicata* White, 1928, loc. cit., p. 285, pl. 38, fig. 8; and for: *Globigerina linnei caliciformis* Lapparent, 1918, Mém. Carte géol. dét. France, Hendaye, pl. 24, fig. 23.
—— *gagnebini* Tilev, **322,** p. 50, pl. 3, figs. 2–5, text figs. 14–17. Upper Cretaceous (Maestrichtian), Turkey.
—— *gansseri* Bolli, **42,** p. 196, pl. 35, figs. 1–3. Upper Cretaceous (Maestrichtian), Trinidad.
—— *intermedia* Bolli, **42,** p. 197, pl. 35, figs. 7–9. Upper Cretaceous (Maestrichtian), Trinidad.
—— *lugeoni* Tilev, **322,** p. 41, pl. 1, figs. 5, 6; pl. 2, figs. 1–12, text figs. 10–12. Upper Cretaceous (middle Maestrichtian), Turkey.
—— —— —— var. *angulata* Tilev, **322,** p. 46, pl. 3, fig. 1, text fig. 13. Upper Cretaceous (Maestrichtian), Turkey.
—— *mayaroensis* Bolli, **42,** p. 198, pl. 35, figs. 10–12. Upper Cretaceous (Maestrichtian), Trinidad.
Glomospira improcera Harris and Jobe, **144,** p. 5, pl. 1, fig. 5. Paleocene, Arkansas, U.S.A.
Goësella paxilla Harris and Jobe, **144,** p. 12, pl. 2, fig. 14. Paleocene, Arkansas, U.S.A.
GUPPYELLA gen. nov. Bronnimann, **48,** p. 98. New genus of family Valvulinidae. Genotype: *Goësella miocenica* Cushman, 1936, Cushman Lab. Foram. Res. Spec. Publ. 6, pl. 5, fig. 9. Miocene.
Guttulina congregalis Harris and Jobe, **144,** p. 31, pl. 6, fig. 11. Paleocene, Arkansas, U.S.A.
Gyroidina globosa (Hagenow, 1842), var. *orbicella* Bandy, **27,** p. 505, pl. 74, fig. 2. Upper Cretaceous (Campanian), California, U.S.A., For *? Gyroidina globosa* Cushman and Goudkoff, 1944 (non Hagenow, 1842), Cushman Lab. Foram. Res., Contr., vol. 20, p. 61, pl. 10, fig. 6
Hanzawaia hamadaensis Asano, **20,** p. 16, figs. 21–23. Pliocene, Japan.
Haplophragmium inconstans inconstans Bartenstein and Brand, **33,** p. 272, pl. 3, figs. 56–58. Lower Cretaceous (upper Valanginian), N.W. Germany.
—— —— *erectum* Bartenstein and Brand, **33,** p. 272, pl. 3, figs. 50–55. Lower Cretaceous (upper Valanginian), N.W. Germany.
—— —— *gracile* Bartenstein and Brand, **33,** p. 272, pl. 3, figs. 59–61. Lower Cretaceous (upper Valanginian), N.W. Germany.
Haplophragmoides longifissus Israelsky, **166,** p. 12, pl. 2, figs. 34, 35. Paleocene-Eocene (Lodo formation), California, U.S.A.
—— *nonionelloides* Israelsky, **166,** p. 11, pl. 2, figs. 28–31. Paleocene-Eocene (Lodo formation), California, U.S.A.
—— *obliquicameratus* Marks, **204,** p. 35, pl. 5, fig. 1. Middle Miocene, Austria.
—— *protrullisatus* Israelsky, **166,** p. 11, pl. 2, figs. 26, 27. Paleocene-Eocene (Lodo formation), California, U.S.A.
—— *robustus* Israelsky, **166,** p. 11, pl. 2, figs. 32, 33. Paleocene-Eocene (Lodo formation), California, U.S.A.
Haplophragmoides ? barrowensis Tappan, **311,** p. 1, pl. 1, fig. 1. Upper Triassic, Alaska.
HEMINWAYINA gen. nov. Bermudez, **38,** p. 325. New genus of family Rotaliidae, subfamily Epistomininae. Genotype: *Discorbis multisectus* Galloway and Heminway, 1941, New York Acad. Sci., Sci. Surv., Porto Rico and Virgin Islands, p. 384, pl. 20, fig. 4. Upper Eocene and Oligocene.
—— *gallowayi* Bermudez, **38,** p. 329, text figs. 7–9. Middle Oligocene, Cuba.
Hemirobulina: see *Robulus.*
Heronallenia otukai Uchio, **332,** p. 39, pl. 3, fig. 5. Upper Pliocene, Japan.
Heterohelix navarroensis Loeblich, 194, p. 107, pl. 12, figs. 1–3, text fig. 1. Upper Cretaceous, Texas, U.S.A.
Heterostomella rolshauseni Harris and Jobe, **144,** p. 10, pl. 2, fig. 9. Paleocene Arkansas, U.S.A. For: *Heterostomella sp.* Kline, 1943, Mississippi State Geol. Surv. Bull. 53, p. 16, pl. 7, fig. 3.
HYALINEA gen. nov. Hofker, **154,** p. 508. New genus of family Rotaliidae (cave *Hyalina* Schumacher, 1817, Studer, 1820, Albers, 1850, and Jung, 1942). Genotype: *Hyalinea baltica* (Schroeter) in Hofker, loc. cit., p. 508, text figs. 345–348. Recent.
Karreriella inflata Israelsky, **166,** p. 24, pl. 10, figs. 7–9; pl. 11, figs. 14–16. Paleocene-Eocene (Lodo formation), California, U.S.A.
—— *? lodoensis* Israelsky, **166,** p. 24, pl. 10, figs. 10–14; pl. 11, figs. 6–9. Paleocene-Eocene (Lodo formation) California, U.S.A.
KETTNERAMMINA gen. nov. Pokorny, **260,** p. 3. New genus of family Hyperamminidae, subfamily Dendrophryinae. Genotype: *Kettnerammina givetiana* Pokorny, 1951, ut infra. Middle Devonian (Givetian).
—— *givetiana* Pokorny, **260,** p. 4, pl. 1, figs. 2–6; text fig. 1. Middle Devonian (Givetian), Czechoslovakia.
—— *(?) mesodevonica* Pokorny, **260,** p. 5, pl. 1, fig. 7, text figs. 2–4. Middle Devonian (Givetian), Czechoslovakia.
LABYRINTHINA gen. nov. Weynschenk, **356,** p. 793. New genus of family Lituolidae. Genotype: *Labyrinthina mirabilis* Weynschenk, 1951, ut infra. Upper Triassic, Austria.
—— *mirabilis* Weynschenk, **356,** p. 793, pl. 112, figs. 4–9, text figs. 1, 2. Upper Triassic, Austria.
Lagena acuticosta Reuss, 1862 var. *brevipostica* Bandy, **27,** p. 502, pl. 73, fig. 19. Upper Cretaceous (Campanian), California, U.S.A.
—— —— —— var. *proboscidialis* Bandy, **27,** p. 503, pl. 73, fig. 16. Upper Cretaceous (Campanian), California, U.S.A.
—— *apiculata* Reuss, 1851, subsp. *neocomiana* Bartenstein and Brand, **33,** p. 317, pl. 10, figs. 275, 276; pl. 13, fig. 353. Lower Cretaceous (upper Valanginian), N.W. Germany.
Lagena hauteriviana hauteriviana Bartenstein and Brand, **33,** p. 317 pl. 10, figs. 277, 278. Lower

Cretaceous (Lower Hauterivian), N.W. Germany. For: *Lagena sp.(?)* Eichenberg, 1934, Niedersächs. Geol. Ver. Hannover, Mitt., vol. 26, p. 182, pl. 12, figs. 13; for: *Nodosaria rudis* Orb. (einkammerig) Eichenberg, 1935, Mitt. Roemer-Mus. Hildesheim, Nr. 35, pl. 11, fig. 19; and for: *Lagena D* 14 (pars) Hecht, 1938, Senckenberg. Naturf. Ges., Abhandl., Nr. 443, p. 17-b, fig. 37; pl. 18-a, figs. 20–35; pl. 18-b, figs. 5–12 and pl. 21, figs. 30–33.

—— —— *cylindracea* Bartenstein and Brand, **33,** p. 318, pl. 10, figs. 279, 280. Lower Cretaceous (lower Hauterivian), N.W. Germany. For: *Lagena gracillima* Seguenza in Eichenberg, 1934, Niedersächs. Geol. Ver. Hannover, Mitt., vol. 26, p. 181, pl. 10, fig. 2; for same species in Eichenberg, 1935, Mitt. Roemer-Mus. Hildesheim, No. 35, pl. 10, fig. 9; and for: *Lagena D 7* Hecht, 1938, Senckenberg. Naturf. Ges., Abhandl. No. 443, pl. 23, figs. 75, 76.

Lagenodosaria tubulata (R. Koch, 1925), var. *japonica* Uchio, **331,** p. 371, fig. 6. Upper Miocene, Japan.

Lenticulina (*Lenticulina*) *eichenbergi* Bartenstein and Brand, **33,** p. 285, pl. 5, figs. 118, 119. Lower Cretaceous (upper Valanginian), N.W. Germany.

—— *fiski* Harris and Jobe, **144,** p. 17, pl. 3, fig. 13. Paleocene, Arkansas, U.S.A.

—— (*Lenticulina*) *guttata* Dam, 1946, subsp. *striata* Bartenstein and Brand, **33,** p. 285, pl. 5, fig. 117. Lower Cretaceous (transition between upper Valanginian and lower Hauterivian), N.W. Germany.

—— *jubata* Harris and Jobe, **144,** p. 17, pl. 3, fig. 12. Paleocene, Arkansas, U.S.A.

—— *morishimai* Inoue and Nakaseko, **164,** p. 10, text fig. 3. Middle Miocene, Japan.

—— (*Lenticulina*) *d'orbigny* Roemer, 1841, subsp. *multireticulosa* Bartenstein and Brand, **33,** p. 282, pl. 5, figs. 133, 134. Lower Cretaceous (upper Valanginian), N.W. Germany.

—— (——) *saxonica saxonica* Bartenstein and Brand, **33,** p. 284, pl. 5, fig. 115. Lower Cretaceous (upper Valanginian), N.W. Germany.

—— (——) —— *bifurcilla* Bartenstein and Brand, **33,** p. 284, pl. 5, fig. 114. Lower Cretaceous (upper Valanginian), N.W. Germany.

Lenticulina (*Marginulinopsis*) *bettenstaedti* Bartenstein and Brand, **33,** p. 290, pl. 6, figs. 144–147. Lower Cretaceous (upper Valanginian), N.W. Germany.

—— (——) *hemicylindrica* Noth, **241,** p. 45, pl. 8, fig. 2. Upper Cretaceous (Senonian), Austria.

—— (——) *oldenburgensis* Bartenstein and Brand, **33,** p. 288, pl. 6, fig. 140. Lower Cretaceous (middle Valanginian), N.W. Germany.

Lenticulina (*Saracenaria*) *praemeudonensis* Noth, **241,** p. 47, pl. 1, fig. 30. Lower Cretaceous (Hauterivian), Austria.

—— (——) *valanginiana* Bartenstein and Brand, **33,** p. 291, pl. 13, figs. 364, 365. Lower Cretaceous (middle Valanginian), N.W.Germany.

Lenticulina (*Vaginulinopsis*) *angulata* Noth, **241,** p. 47, pl. 4, fig. 26. Middle Cretaceous (Albian), Austria.

—— (——) —— var. *decemcostata* Noth, **241,** p. 47, pl. 1, fig. 29. Middle Cretaceous (Albian), Austria.

—— (——) *humilis* (Reuss, 1863) subsp. *praecursoria* Bartenstein and Brand, **33,** p. 287, pl. 5, figs. 126, 127. Lower Cretaceous (upper Valanginian), N.W. Germany.

—— (——) *korneuburgensis* Noth, **241,** p. 46, pl. 1, figs. 26, 27. Lower Cretaceous (Hauterivian), Austria.

Lingulina alaskensis Tappan, **311,** p. 1, pl. 1, fig. 2. Upper Triassic, Alaska.

—— *biformis* Bartenstein and Brand, **33,** p. 300, pl. 8, figs. 188–190. Lower Cretaceous (upper Valanginian), N.W. Germany.

—— *borealis* Tappan, **309,** p. 13, pl. 4, figs. 5–8, 14–17. Upper Triassic, Alaska.

Listerella minuta Hofker, **154,** p. 27, text fig. 6. Recent, Indonesia, 490–977 fathoms. (Note: Preoccupied by Hussey, 1949, Jour. Paleontology, vol. 23, p. 119, pl. 26, fig. 2; changed to *Schenckiella exigua* (Hofker, 1952), nom. nov. Cushman Found. Foram. Res., Contr., vol. 3, p. 14, because *Listerella* has been renamed *Schenckiella*.)

Lituotuba nussbachensis Noth, **241,** p. 28, pl. 6, fig. 14. Upper Cretaceous (Senonian), Austria.

Loxostoma (recte: *Loxostomum*) *cuneatum* Hofker, **154,** p. 87, text figs. 49, 50. Recent Indonesia.

—— *incertum* Hofker, **154,** p. 55, text fig. 23. Recent, off Sumbawa, Indonesia, 340 fathoms.

Loxostomum koikei Uchio, **332,** p. 35, pl. 3, fig. 6. Upper Pliocene, Japan.

—— *limpidum* Harris and Jobe, **144,** p. 43, pl. 8, fig. 4. Paleocene, Arkansas, U.S.A.

—— *truncatum* Phleger and F. L. Parker, **257,** p. 17, pl. 7, figs. 15–19. Recent, N.W. Gulf of Mexico. (Note: Preoccupied by Finlay, 1947, New Zealand Jour. Sci. Technol., vol. 28, sect. B, p. 280, pl. 6, figs. 91–96. and, therefore, renamed *Loxostomum abruptum* nom. nov. Phleger and F. L. Parker, 1952. Cushman Found. Foram. Res., Contr., vol. 3, p. 14.)

MARENDA gen. nov. Nyholm, **245,** p. 91, New genus of family ?Allogromiidae. Genotype: *Marenda nematoides* Nyholm, 1951, ut infra. Recent.

—— *nematoides* Nyholm, **245,** p. 92, pl. 11, figs. 1–3; text figs. 1–14. Recent, Mediterranean Sea, 8–20 meters.

Marginolamellidae fam. nov. Hofker, **154,** p. 485. Includes the genera *Globotruncana* Cushman, 1927; *Globorotalia* Cushman, 1927; *Globorotalites* Brotzen, 1942; *Rotalipora* Brotzen, 1942; and *Cancris* Montfort, 1808.

Marginulina planata Phleger and F. L. Parker, **257,** p. 9, pl. 4, figs. 21, 22; pl. 5, figs. 1–3. Recent, N.W. Gulf of Mexico, 57 meters.

—— *prisca* Tappan, **309,** p. 10, pl. 2, figs. 20–23. Upper Triassic, Alaska.

—— *similis* d'Orbigny, 1846, var. *obliquinodus* Bandy, **27,** p. 498, pl. 73, fig. 2. Upper Cretaceous (Campanian), California, U.S.A.

—— *subglabrans* Harris and Jobe, **144,** p. 18, pl. 4, figs. 1, 2. Paleocene, Arkansas, U.S.A.

—— *utsunomiyensis* Uchio, **331,** p. 370, fig. 5. Upper Miocene, Japan.

Marginulinopsis ammonitiformis Young, **359,** p.

52, pl. 11, figs. 12, 23; text fig. 5, Nos. 9–12. Upper Cretaceous, Montana, U.S.A.
—— *amplaspira* Young, **359,** p. 54, pl. 11, figs. 15, 17–21; pl. 12, figs. 1–4, 6, 8–14; text fig. 5, Nos. 14–16, 18–21, text fig. 6, Nos. 2–16, 20. Upper Cretaceous, Montana, U.S.A.
—— *frontierensis* Young, **359,** p. 52, pl. 11, figs. 9–12; text fig. 5, Nos. 2–8. Upper Cretaceous, Montana, U.S.A.
—— *umiatensis* Tappen, **311,** p. 2, pl. 1, figs. 6, 7. Lower Cretaceous, Alaska.
—— see also: *Lenticulina*.
Marssonella angulata Israelsky, **166,** p. 21, pl. 9, figs. 7–9; pl. 10, figs. 28, 29. Paleocene-Eocene (Lodo formation), California, U.S.A.
—— *impendens* Israelsky, **166,** p. 21, pl. 9, figs. 10–12; pl. 10, figs. 30–34. Paleocene-Eocene (Lodo formation), California, U.S.A.
—— *lodoensis* Israelsky, **166,** p. 21, pl. 9, figs. 1–6; pl. 10, figs. 26, 27. Paleocene-Eocene (Lodo formation), California, U.S.A.
Massilina plummerae Harris and Jobe, **144,** p. 14, pl. 3, fig. 1. Paleocene, Arkansas, U.S.A.
Miliammina valdensis Bartenstein and Brand, **33,** p. 277, pl. 13, figs. 360–361. Lower Cretaceous (Wealden), N.W. Germany.
Miogypsina (*Miogypsinella*) *bermudezi* Drooger, **94,** p. 357, text figs. 1–6. Middle Oligocene, Cuba.
Miogypsinella, see *Miogypsina*
MORAVAMMINA Pokorny, **260,** p. 7. New genus of family Hyperamminidae, subfamily Moravammininae Pokorny, 1951, ut infra. Genotype: *Moravammina segmentata* Pokorny 1951, ut infra. Middle Devonian (Givetian).
—— *segmentata* Pokorny, **260,** p. 8, text figs. 5–7. Middle Devonian (Givetian), Czechoslovakia. For: *Lituotuba* sp. Bartenstein, 1937, Senckenbergiana, vol. 19, p. 335, text fig. 5.
Moravammininae subfam. nov. Pokorny, **260,** p. 7. Includes only genus *Moravammina* Pokorny, 1951, ut supra. Middle and Upper Devonian.
Nagatoella fujimotoi Morikawa, **221,** p. 82, pl. 8, figs. 1–8. Middle Permian, Japan.
NAVARELLA gen. nov. Ciry and Rat, **64,** p. 85. New genus of fam. Lituolidae. Genotype: *Navarella joaquini* Ciry and Rat, 1951, ut infra. Upper Cretaceous.
—— *joaquini* Ciry and Rat, **64,** p. 85, pl. 2, figs. 1–7; text figs. 1, 2. Upper Cretaceous, Spain.
Neoalveolina vonderschmitti Schweighauser, **287-a,** p. 468, text figs. 1–5. Upper Eocene, Italy.
NEOCONORBINA gen. nov. Hofker, **154,** p. 433. New genus of family Conorboididae. Genotype: *Neoconorbina pacifica* Hofker, 1951, ut infra. Tertiary to Recent.
—— *marginata* Hofker, **154,** p. 435, text figs. 298, 299. Recent, Indonesia, 340–777 fathoms.
—— *neapolitana* Hofker, **154,** p. 438, text figs. 300, 301. Recent, Bay of Naples, Italy.
—— *pacifica* Hofker, **154,** p. 438, text figs. 302, 303. Recent, Sunda Straits, Indonesia.
NEOUVIGERINA gen. nov. Hofker, **154,** p. 206. New genus of family Uvigerinidae. Genotype (not stated by Hofker), here designated as: *Neouvigerina ampullacea* (Brady) in Hofker, 1951, loc. cit., p. 208, text figs. 135–138, Recent, off southern Sumatra. Oligocene to Recent.
Nodophthalmidium butellum Bartenstein and Brand, **33,** p. 279, pl. 4, fig. 92. Lower Cretaceous (upper Valanginian), N.W. Germany.
Nodosaria bighornensis Young, **359,** p. 58, pl. 12, figs. 17, 19. Upper Cretaceous, Montana, U.S.A.
—— *larina* Tappan, **309,** p. 11, pl. 3, figs. 5–8, Upper Triassic, Alaska.
—— *liratella* Tappan, **309,** p. 11, pl. 3, figs. 17–20. Upper Triassic, Alaska.
—— *sceptrum* Reuss, 1863, subsp. *spinicostata* Bartenstein and Brand, **33,** p. 313, pl. 10, figs. 255, 256. Lower Cretaceous (middle Valanginian), N.W. Germany (cave *Nodosaria spinicosta* Orbigny, 1846).
—— *shublikensis* Tappan, **311,** p. 1, pl. 1, fig. 2. Lower Jurassic, Alaska.
—— *xavierensis* Young, **359,** p. 59, pl. 12, fig. 15; pl. 13, figs. 11, 12. Upper Cretaceous, Montana, U.S.A.
Nonion boueanum (Orbigny, 1846) var. *multilobum* Uchio, **331,** p. 371, fig. 2. Middle Miocene, Japan.
—— *ecuadoranum* Cushman and Stainforth, **76,** p. 149, pl. 26, figs. 19, 20. Upper Eocene, Ecuador.
Nummulites burdigalensis de la Harpe, 1926, subsp. *pergranulatus* Schaub, **286,** p. 122, text fig. 82; pl. 3, No. 2. Eocene (upper Ypresian), Switzerland.
—— *buxtorfi* Schaub, **286,** p. 190, text figs. 277–284; pl. 8, Nos. 6–14. Eocene (upper Ypresian), Switzerland.
—— *delaharpei* nom. nov. Said **283,** p. 121. Eocene (Lutetian), Egypt. New name for: *Nummulites gizehensis ehrenbergi* de la Harpe, 1881, Mém. Soc. Paléont. Suisse, vol. 8, pl. 1, fig. 11; and for: *N. gizehensis visqueneli* de la Harpe, 1883, Palaeontogr., vol. 30, p. 195, pl. 34, figs. 15–24.
—— *exilis* H. Douvillé, 1919, subsp. *involutus* Schaub, **286,** p. 168, text figs. 226, 257; pl. 5, Nos. 9–11. Eocene (lower Ypresian), Switzerland.
—— —— —— subsp. *robustus* Schaub, **286,** p. 168, text figs. 227–230. Eocene (upper Ypresian), S.W. France.
—— *globulus* Leymerie, 1846, subsp. *increscens* Schaub, **286,** p. 107, text figs. 53–58; pl. 1, Nos. 2, 3. Eocene (upper Ypresian), Switzerland.
—— (*Nummulites*) *henrici* Cizancourt, **66,** p. 48, pl. 4, figs. 1–3. Paleocene, Venezuela.
—— *inkermanensis* nom. nov. Schaub, **286,** p. p. 124, text fig. 97. Eocene, Crimea. New name for: *Nummulina taurica* de la Harpe forma B in Rozlozsnik, 1929, Studien über Numm., p. 116, pl. 2, fig. 13, 21, 22, 25; pl. 7, fig. 4.
—— *leupoldi* Schaub, **286,** p. 159, text figs. 206–214; pl. 5, Nrs. 3–7. Eocene (upper Ypresian), Switzerland. For: *Nummulites granifer* H. Douvillé, B-form in: Arni, 1939, Eclog. geol. Helvetiae, vol. 32, pl. 9, figs. 4a–c.
—— *nitidus* de la Harpe, 1883, subsp. *inflatus* Schaub, **286,** p. 164, text figs. 217–218. Paleocene-Ypresian boundary, Switzerland. (Note: A probable or possible, homonym of *N. in-*

flatus Risso, 1826, Hist. Nat. Europe, vol. 4, p. 26, if Risso's species is properly described and figured.)

—— —— —— subsp. *laxus* Schaub, **286,** p. 163, text fig. 216. Paleocene-Ypresian boundary, Switzerland.

—— *partschi* de la Harpe, 1880, subsp. *aequalispira* Schaub, **286,** p. 152, text fig. 184; pl. 4 No. 16. Eocene (lower Ypresian), Switzerland.

—— *pernotus* Schaub, **286,** p. 108, text figs. 59–67; pl. 1, Nos. 7–11. Paleocene-Ypresian boundary, Switzerland.

—— —— —— subsp. *angustus* Schaub, **286,** p. 113, text fig. 73; pl. 1, No. 12. Uppermost lower Ypresian, Switzerland.

—— —— —— subsp. *paraburdigalensis* Schaub, **286,** p. 111, text figs. 68–72. Eocene (upper Ypresian), Switzerland.

—— *planulatus* Lamarck, 1804, subsp. *cussacensis* Schaub, **286,** p. 178, text figs. 248, 253–255, 257; pl. 6, Nos. 6, 8. Paleocene-Ypresian boundary, Switzerland.

—— —— —— subsp. *planissimus* Schaub, **286,** p. 181, text fig. 251. Eocene (upper Ypresian), Switzerland.

—— —— —— subsp. *thaliciformis* Schaub, **286,** p. 179, text figs. 249, 250, 256; pl. 6, No. 7. Eocene (lower Ypresian), Switzerland.

—— *praecursor* de la Harpe, 1883, subsp. *alpinus* Schaub, **286,** p. 138, text figs. 152–156; pl. 3, Nos. 14, 15. Uppermost Paleocene, Switzerland.

—— —— —— subsp. *ornatus* Schaub, **286,** p. 139, text figs. 157, 158; pl. 3, Nos. 12, 13. Eocene (lower Ypresian), Switzerland.

—— *praelaevigatus* Schaub, **286,** p. 188, text figs. 273–275, 257; pl. 8, Nos. 1, 2. Eocene (upper Ypresian), Switzerland.

—— *rotularius* Deshayes, 1838, subsp. *praevius* Schaub, **286,** p. 125, text figs. 117, 118. Eocene (lower Ypresian), Switzerland.

—— (*Nummulites*) *sanctijoanni* Cizancourt, **66,** p. 48, pl. 4, figs. 8, 9. Paleocene, Venezuela.

—— *silvanus* Schaub, **286,** p. 153, text fig. 188; pl. 5, No. 8. Eocene (upper Ypresian), Switzerland.

—— —— —— subsp. *gallicus* Schaub, **286,** p. 154, text figs. 195, 196. Eocene (lower Ypresian), Switzerland. (Note: Possibly a homonym of *N. striatus* (Orbigny, 1850) var. *gallica* Tellini, 1888, Boll. Soc. geol. Italiana, vol. 7, p. 197 if Tellini's variety has been properly proposed.)

—— *subplanulatus* Hantken and Madarasz, 1872, subsp. *soerenbergensis* Schaub, **286,** p. 101, text figs. 37–41; pl. 1, Nos. 4–6. Paleocene-Ypresian boundary, Switzerland.

—— *subramondi* de la Harpe, 1883, subsp. *maior* Schaub, **286,** p. 130, text figs. 128–132; pl. 3, Nos. 10, 11. Eocene (upper Ypresian), Switzerland. (Note: Varietal name preoccupied by Grönwald, 1927, and by Rozlosznik, 1929. See comments under "Homonyms in 1951.")

—— *vonderschmitti* Schaub, **286,** p. 171, text figs. 233–240; pl. 5, Nos. 12–19. Eocene (upper Ypresian), Switzerland.

—— —— —— subsp. *tenuis* Schaub, **286,** p. 174, text figs. 241–243; pl. 6, Nos. 1–5. Eocene (upper Ypresian), Switzerland.

OKETAELIA gen. nov. Thompson, **320,** p. 116. New genus of family Fusulinidae. Genotype: *Oketaella fryei* Thompson, 1951, ut infra. Permian (middle Wolfcampian).

—— *fryei* Thompson, **320,** p. 116, pl. 13, figs. 1–12. Permian (Wolfcampian), Kansas.

Orbulina suturalis Bronnimann, **51,** p. 135, text fig. 2, figs. 1–5; text fig. 3, figs. 3–8, 11, 13–16, 18, 20–22; text fig. 4, figs. 2–4, 7–12, 15, 16, 19–22. Upper Oligocene to lower Miocene, Trinidad.

Palmula primitiva Cushman, 1939, var. *expansa* Harris and Jobe, **144,** p. 29, pl. 5, fig. 14. Paleocene, Arkansas, U.S.A.

PARAMILLERELLA gen. nov. Thompson, **320,** p. 115. New genus of family Fusulinidae. Genotype: *Millerella ? advena* Thompson, 1944, Kansas Geol. Surv. Bull. 52, p. 427, pl. 1, figs. 10–14. Late Mississippian to Pennsylvanian.

PARATEXTULARIA gen. nov. Pokorny, **260,** p. 20. New genus of family Textulariidae. Genotype: *Textularia (?) proboscidea* Cushman and Stainbrook, 1943, Cushman Lab. Foram. Res. Contr., vol. 19, p. 78, pl. 13, figs. 29–34. Middle and Upper Devonian.

PARVISTELLITES gen. nov. O. Wetzel, **354,** p. 113 (*foraminifer problematicum*). Genotype: *Parvistellites hospitalis* O. Wetzel, 1951, ut infra. Reworked in flint boulders.

—— *hospitalis* O. Wetzel, **354,** p. 113, pl. 14, fig. 1. Flint boulder in Alluvium, North Germany. For: *(?) cf. Protocyclina liasina* Paalzow 1932, Abhandl. Naturf. Ges. Nurnberg, vol. 22, p. 35, pl. 4, figs. 11–14, especially fig. 13.

PEALERINA nom. nov. Lalicker, **186,** p. 237, new name for *Ellisina* Lalicker, 1950, non Norman, 1903. (Note: See Nomina Nova 1950, Jour. Paleontology, vol. 26, p. 262.)

Placopsilina neocomiana Bartenstein and Brand, **33,** p. 280, pl. 4, fig. 100. Lower Cretaceous (upper Valanginian), N.W. Germany.

Planularia crosswicksana McLean, **213,** p. 24, pl. 4, fig. 3. Paleocene, New Jersey, U.S.A.

—— *klineae* Harris and Jobe, **144,** p. 18, pl. 3, fig. 10. Paleocene, Arkansas, U.S.A.

—— see also *Robulus*.

Planulina exorna Phleger and F. L. Parker, **257,** p. 32, pl. 18, figs. 5–8. Recent, N.W. Gulf of Mexico, 57 meters.

—— *mascula* Bandy, **27,** p. 506, pl. 74, fig. 8. Upper Cretaceous (Campanian), California, U.S.A.

—— *multipunctata* Bandy, **27,** p. 506, pl. 74, fig. 9. Upper Cretaceous (Campanian), California, U.S.A.

—— *subdepressa* Asano, **20,** p. 15, figs. 16–18. Pliocene, Japan.

Plectina nuttalli Cushman and Stainforth, **76,** p. 144, pl. 25, figs. 26, 27. Upper Eocene, Ecuador. For: *Plectina dalmatina* Nuttall, 1935 (non Liebus, 1911) Jour. Paleontology, vol. 9, p. 123, pl. 14, fig. 8.

Plectofrondicularia billmani Rau, **267,** p. 438, pl. 65, fig. 3. Miocene, Washington, U.S.A.

—— *niinoi* Uchio, **331,** p. 373, figs. 12, 13. Upper Miocene, Japan.

Pleurostomella ecuadorana Cushman and Stainforth, **76,** p. 156, pl. 26, fig. 64. Upper Eocene, Ecuador.

Polymorphina palmaris Harris and Jobe, **144,** p. 34, pl. 7, fig. 2. Paleocene, Arkansas, U.S.A.

—— —— —— var. *parallela* Harris and Jobe, **144,** p. 34, pl. 7, fig. 1. Paleocene, Arkansas, U.S.A. (Note: Preoccupied by *Polymorphina regularis* Muenster, 1838, var. *parallela* Millett, 1894, Roy. Geol. Soc. Cornwall, Trans., p. 4, figs. 5, 6. According to letter, dated June 16, 1952, the authors will rename their homonym *Polymorphina undacuneata* nom. nov.)

Poroeponides cribroconcameratus Asano, **21,** p. 18, figs. 132, 133. Pliocene, Japan.

—— *cribrorepandus* Asano and Uchio in Asano, **21,** p. 18, figs. 134, 135. Pliocene, Japan.

PRAEBULIMINA gen. nov. Hofker, **154,** p. 144. New genus of family Buliminidae. Genotype: not given by author, here designated as *Praebulimina spec.* Hofker, 1951, loc. cit., p. 145, text fig. 88, Upper Cretaceous, Netherlands. Upper Cretaceous.

—— *spec.* Hofker, 154, p. 145, text fig. 88. Upper Cretaceous, Netherlands. (Note: This is the genotype, designated by the compiler, for Hofker's new genus *Praebulimina* ut supra. Hofker omitted also the designation of a type locality for this species.)

PRAEGLOBOBULIMINA gen. nov. Hofker, **154,** p. 248. New genus of family Virgulinidae, subfamily Globobulimininae. Genotype: *Bulimina pyrula* d'Orbigny, 1846, var. *spinescens* Brady, 1884, Report "Challenger," Zool., vol. 9, p. 400, pl. 50, figs. 11, 12. Recent.

PRAEPENEROPLIS nom. nov. Hofker, **152-a,** p. 463 (published June, 1952). New name for *Protopeneroplis* Hofker, 1950 (non Weynschenk, 1950). Genotype: *Protopeneroplis senoniensis* Hofker, 1949. Upper Cretaceous to Eocene.

PRAEUVIGERINA gen. nov. Hofker, **154,** p. 188. New genus of family Uvigerinidae. Genotype: Here designated as *Praeuvigerina westphalica* (Franke) in Hofker, 1951, loc. cit., p. 189, text fig. 119. Upper Cretaceous (Senonian).

Proporocyclina see *Pseudophragmina.*

Proteonina comprima Phleger and F. L. Parker, **257,** p. 2, pl. 1, figs. 1–3. Recent, N.W. Gulf of Mexico, 91 meters. (Probably a *Nouria.*)

PROTOGLOBOBULIMINA gen. nov. Hofker, **154,** p. 252. New genus of family Virgulinidae, subfamily Globobulimininae. Genotype: *Protoglobobulimina pupoides* (d'Orbigny) in Hofker, 1951, loc. cit., p. 252, text fig. 168, Recent, Indonesia. Recent.

Protoforaminata sub-ordo nov. Hofker, **154,** p. 42. New sub-order of Dentata Hofker, 1951, ut supra. Comprises the families: Bolivinidae, Buliminidae, Buliminellidae, Cassidulinidae, Uvigerinidae, Valvulinidae, and Virgulinidae.

Psammosphaera eocenica Cushman and Stainforth, **76,** p. 142, pl. 25, figs. 6, 7. Upper Eocene, Ecuador.

Pseudoclavulina copiosa Israelsky, **166,** p. 20, pl. 7, figs. 34–36; pl. 8, figs. 1–4. Paleocene-Eocene (Lodo formation), California, U.S.A.

—— *emaciata* Israelsky, **166,** p. 19, pl. 7, figs. 30–33. Paleocene-Eocene (Lodo formation), California, U.S.A.

—— *prismatica* Israelsky, **166,** p. 19, pl. 8, figs. 5–8. Paleocene-Eocene (Lodo formation), California, U.S.A.

—— *variata* Israelsky, **166,** p. 19, pl. 7, figs. 25–29. Paleocene-Eocene (Lodo formation), California, U.S.A.

PSEUDOFUSULINELLA gen. nov. Thompson, **320,** p. 117. New genus of family Fusulinidae. Genotype: *Neofusulinella occidentalis* Thompson and Wheeler, 1946, Geol. Soc. America, Mem. 17, p. 25, pl. 2, figs. 1–4. Lower and Middle Permian.

Pseudogaudryina see *Gaudryina*

Pseudoglandulina densa Tappan, **309,** p. 12, pl. 4, figs. 9–13. Upper Triassic, Alaska.

—— *lata* Tappan, **309,** p. 12, pl. 3, figs. 15, 16. Upper Triassic, Alaska.

—— *mutabilis* (Reuss, 1863) subsp. *striata* Bartenstein and Brand, **33,** p. 316, pl. 10, fig. 272. Lower Cretaceous (upper Valanginian), N.W. Germany.

—— *nallpeensis* Rau, **267,** p. 435, pl. 64, fig. 8. Upper Eocene, Washington, U.S.A.

—— *simpsonensis* Tappan, **309,** p. 12, pl. 3, figs. 9–14. Upper Triassic, Alaska.

Pseudonubecularia lepida Bartenstein and Brand, **33,** p. 278, pl. 4, figs. 85. Lower Cretaceous (middle Valanginian), N.W. Germany.

Pseudoparrella (?) decorata Phleger and F. L. Parker, **257,** p. 28, pl. 15, figs. 4, 5. Recent, N.W. Gulf of Mexico.

—— *(?) rugosa* Phleger and F. L. Parker, **257,** p. 28, pl. 15, figs. 8, 9. Recent, N.W. Gulf of Mexico, 731 meters.

Pseudophragmina (Proporocyclina) renzi Cizancourt, **66,** p. 53, pl. 3, figs. 1–3, 5. Lower middle Eocene, Venezuela.

Pseudouvigerina naheolensis Cushman and Todd, 1942, var. *torta* Harris and Jobe, **144,** p. 40, pl. 7, fig. 15. Paleocene, Arkansas, U.S.A.

PULLENOIDES gen. nov. Hofker, **153,** p. 10. New genus of family Cassidulinidae. Genotype: *Pullenoides senoniensis* Hofker, 1951, ut infra. Upper Cretaceous.

—— *senoniensis* Hofker, **153,** p. 10, text figs. 11–13. Upper Cretaceous (upper Senonian), Netherlands.

PUTEOLINA nom. nov. Hofker, **152-a,** p. 450 (published June 1952). New name for *Puteolus* Hofker, 1950 (non Monterosato, 1888, a molluscan genus). Genotype: *Peneroplis protea* Orbigny, 1839. Eocene to Recent.

—— *crassa* Hofker, **152-a,** p. 455, text fig. 42. Recent, West Indies.

—— *malayensis* Hofker, **152-a,** p. 456, text fig. 43. Recent, Indonesia, 278 meters. For: *Archaias discoideus* (Flint) in Hofker, 1930, Siboga Exped., Monogr. IV-a, pt. 2, p. 147, pl. 56, figs. 1–12.

Pyrgo depressa (Orbigny, 1826), var. *tomiyensis* Uchio, **332,** p. 34, pl. 3, fig. 9. Upper Pliocene, Japan.

—— *pseudoinornata* Cushman and Stainforth, **76,** p. 145, pl. 25, fig. 39. Upper Eocene, Ecuador.

Pyrulina hamadaensis Asano, **19,** p. 5, figs. 27, 28. Pliocene, Japan.
—— *langi* Harris and Jobe, **144,** p. 33, pl. 6, fig. 20. Paleocene, Arkansas, U.S.A.
Pyrulinoides plagia Tappan, **309,** p. 15, pl. 4, figs. 25–27. Upper Triassic, Alaska.
Quinqueloculina orbiculata Cushman and Stainforth, **76,** p. 145, pl. 25, fig. 32. Upper Eocene, Ecuador (cave *Quinqueloculina orbicularis* d'Orbigny, 1826).
—— *producta* Harris and Jobe, **144,** p. 13, pl. 3, fig. 2. Paleocene, Arkansas, U.S.A.
—— *sawanensis* Asano, **18,** p. 6, figs. 40–42. Pliocene, Japan.
Ramulina aptiensis Bartenstein and Brand, **33,** p. 323, pl. 11, fig. 332. Lower Cretaceous (upper Valanginian), N.W. Germany. For synonymy see original publication.
—— *tappanae* Bartenstein and Brand, **33,** p. 322, pl. 11, figs. 305–307. Lower Cretaceous (upper Valanginian), N.W. Germany. For synonymy consult original publication.
Rectobolivina asanoi Murata, **225,** p. 96, pl. 1, fig. 2. Miocene, Japan.
Reophax inordinatus Young, **359,** p. 48, pl. 11, figs. 1, 2. Upper Cretaceous. Montana, U.S.A.
—— *minutissima* Bartenstein and Brand, **33,** p. 266, pl. 1, fig. 12. Lower Cretaceous (transition between upper Valanginian and lower Hauterivian), N.W. Germany. (Note: Preoccupied by Plummer, 1944, Univ. Texas Bull. 4401, p. 230, pl. 17, figs. 25–30 for a species from Pennsylvanian of Texas. According to letter, dated April 1, 1952, the authors will rename their homonym: *Reophax neominutissima* nom. nov.)
—— *sabulosus* Harris and Jobe, **144,** p. 5, pl. 1, fig. 3. Paleocene, Arkansas, U.S.A. (Note: Preoccupied by Brady, 1881, Quart. Jour. Micr. Soc., vol. 21, p. 49. Will be changed to *Reophax hempsteadensis* nom. nov. by Harris and Jobe, according to letter, dated June 16, 1952.)
Reussella weberi Hofker, **154,** p. 170, text figs. 106, 107. Recent, off Sumatra, 377 fathoms.
Rhizammina grilli Noth, **241,** p. 21, pl. 6, fig. 5. Upper Cretaceous (Senonian), Austria.
Robulus becki, Rau, **267,** p. 431, pl. 63, figs. 19, 20. Upper Eocene, Washington, U.S.A. For: *Robulus sp. a* Beck, 1943, Jour. Paleontology, vol. 17, p. 596, pl. 101, figs. 9, 10.
—— *clericii* (Fornasini, 1901) var. *carinata* Marks, **204,** p. 42, pl. 5, fig. 9. Middle Miocene, Austria. (Note: Preoccupied by *Robulus* (*Robulina*) *carinata* Dunikowski, 1879, Kosmos, Lemberg, vol. 4, p. 128, pl. 21.)
—— *holcombensis* Rau, **267,** p. 431, pl. 63, figs. 14–17. Upper Eocene-Lower Oligocene, Washington, U.S.A. For synonymy see original publication.
—— *incisus* Lys, **199,** p. 92, pl. 1, figs. 12. Paleocene, Senegal, French West Africa.
—— —— —— var. *evolutus* Lys, **199,** p. 94, pl. 1, fig. 3. Paleocene, Senegal. (Note: Preoccupied by *Robulus evolutus* LeRoy, 1941, Quart. Colorado School of Mines, vol. 35, p. 73, pl. 7, figs. 26, 27. Will be changed to: *Robulus incisus* Lys var. *evolvens* nom. nov., according to letter, dated August, 28, 1951, received from M. Lys. This variety is assigned to the subgenus *Hemirobulina*.)
—— —— —— var. *helicoidalis* Lys, **199,** p. 96, pl. 2, fig. 14. Paleocene, Senegal, French West Africa. (This variety is assigned to the subgenus *Planularia*.)
—— —— —— var. *planiformis* Lys, **199,** p. 94, pl. 2, fig. 10. Paleocene, Senegal, French West Africa. (This variety is assigned by Lys to the subgenus *Planularia*.)
—— *jerseyanus* McLean, **213,** p. 23, pl. 4, fig. 2. Paleocene, New Jersey, U.S.A. For: *Robulus* sp. cf. *R. piluliferus* Shifflett, 1948, Maryland Board Nat. Resources, Dept. Geol. etc., Bull. 3, p. 23, pl. 5, fig. 11.
—— *modestus* Bandy, **27,** p. 493, pl. 72, fig. 9. Upper Cretaceous (Campanian), California, U.S.A.
—— *pre-incisus* Lys, **199,** p. 96, pl. 1, fig. 4. Upper Cretaceous (Santonian), Cameroun, French West Africa.
—— *pseudo-costatus* (Plummer, 1927) var. *comis* nom. nov. Cushman, **75,** p. 14, pl. 4, figs. 13, 14. Paleocene, Mississippi, U.S.A. New name for: *Robulus pseudo-costatus* (Plummer) var. *ornatus* Kline, 1943 (non d'Orbigny, 1846), Mississippi Geol. Surv. Bull. 53, p. 18, pl. 1, fig. 6.
Rotalia asanoi nom. nov. Uchio, **331,** p. 375, text figs. a–c. Recent, Japan. New name for: *Rotalia beccarii* Asano, 1938 (non Linnaeus, 1758), Rept. Inst. Geol. Paleont., Tohoku Imp. Univ. Sendai, No. 31 (in Japanese), pl. 4, fig. 1.
—— *beccarii* (Linnaeus, 1758), var. *aomoriensis* Asano, **21,** p. 13, figs. 96–98. Pliocene, Japan.
—— *ikebei* Inoue and Nakaseko, **164,** p. 11, text fig. 4. Middle Miocene, Japan.
—— *ozawai* Asano, **21,** p. 15, text figs. 115–117. Pliocene, Japan.
—— *sadoensis* Asano, **21,** p. 16, text figs. 120, 121. Pliocene, Japan.
—— *stachi* Asano, **21,** p. 16, figs. 122, 123. Pliocene, Japan.
—— *tochigiensis* Uchio, **331,** p. 374, fig. 1. Middle Miocene, Japan.
"*Rotalia*" *pauciloculata* Phleger and F. L. Parker, **257,** p. 23, pl. 12, figs. 8, 9. Recent, N.W. Gulf of Mexico.
—— *translucens* Phleger and F. L. Parker, **257,** p. 24, pl. 12, figs. 11, 12. Recent, N.W. Gulf of Mexico.
SAGOPLECTA gen. nov. Tappan, **309,** p. 14. New genus of family Polymorphinidae, subfamily Polymorphininae. Genotype: *Sagoplecta goniata* Tappan, 1951, ut infra. Triassic.
—— *goniata* Tappan, **309,** p. 14, pl. 5, figs. 1–8. Upper Triassic, Alaska.
—— *himatioides* Tappan, **309,** p. 15, pl. 5, figs. 9–13. Upper Triassic, Alaska.
—— *incrassata* Tappan, **309,** p. 15, pl. 5, figs. 14–16. Upper Triassic, Alaska.
Saracenaria curvabilis Harris and Jobe, **144,** p. 25, pl. 5, fig. 9. Paleocene, Arkansas, U.S.A.
—— *subglobosa* Bandy, **27,** p. 493, pl. 72, fig. 10. Upper Cretaceous (Campanian), California, U.S.A.

—— see also *Lenticulina*
Schenckiella rugosa Israelsky, **166,** p. 25, pl. 10, figs. 15–19; pl. 11, figs. 10–13. Paleocene-Eocene (Lodo formation), California, U.S.A.
—— see also *Listerella*
Sigmoilina distorta Phleger and F. L. Parker, **257,** p. 8, pl. 4, figs. 3–5. Recent, N.W. Gulf of Mexico.
Sigmomorphina notoensis Asano, **19,** p. 11, figs. 54, 55. Miocene, Japan.
—— *pseudoschencki* Rau, **267,** p. 436, pl. 64, fig. 11. Oligocene, Washington, U.S.A. For: *Sigmomorphina schencki* Rau, 1948 (non Cushman and Ozawa, 1930), Jour. Paleontology, vol. 22, p. 170, pl. 30, figs. 13, 14.
Silicosigmoilina (*Bramletteia*) *perplexa* Israelsky, **166,** p. 11, pl. 2, figs. 22–25; pl. 10, fig. 21. Paleocene-Eocene (Lodo formation), California, U.S.A. Subgenotype.
Siphotextularia rolshauseni Phleger and F. L. Parker, **257,** p. 4, pl. 1, figs. 23, 24. Recent, N.W. Gulf of Mexico.
Spirillina gurgitata Tappan, **309,** p. 16, pl. 5, figs. 20–22. Upper Triassic, Alaska.
Spiroloculina duestensis Bartenstein and Brand, **33,** p. 277, pl. 4, fig. 81. Lower Cretaceous (upper Valanginian), N.W. Germany.
Spiroplectammina bolivinoides Israelsky, **166,** p. 13, pl. 3, figs. 20–24. Paleocene-Eocene (Lodo formation), California, U.S.A.
—— *densa* Israelsky, **166,** p. 14, pl. 3, figs. 27–31. Paleocene-Eocene (Lodo formation), California, U.S.A.
—— *mcnultyi* Harris and Jobe, **144,** p. 8, pl. 1, fig. 12. Paleocene, Arkansas, U.S.A.
—— *perplexa* Israelsky, **166,** p. 12, pl. 3, figs. 9–14. Paleocene-Eocene (Lodo formation), California, U.S.A. For synonymy see original publication.
—— *praelaevis* Israelsky, **166,** p. 14, pl. 3, figs. 25, 26. Paleocene-Eocene (Lodo formation), California, U.S.A.
Stensiöina brotzeni Vasicek, **337,** p. 85, pl. 1, figs. 1–7. Upper Eocene, Czechoslovakia, probably reworked from Upper Cretaceous.
—— *olgae* Vasicek, **337,** p. 88, pl. 2, figs. 1–7. Uppermost Cretaceous, Moravia, Czechoslovakia.
Streblus batavus Hofker, **154,** p. 492 and 498, text figs. 340, 341. Recent, Zuidersee, Netherlands.
—— *turgidus* Hofker, **154,** p. 492 and 502, text fig. 342. Recent, Indonesia and Philippine Islands.
Tetraplasia quadrata Bartenstein and Brand, **33,** p. 275, pl. 3, fig. 72. Lower Cretaceous (upper Valanginian), N.W. Germany.
Textularia losangica Loeblich and Tappan, 196, p. 82, pl. 2, figs. 4, 5. Lower Cretaceous, Texas, U.S.A. For: *Textularia washitensis* Tappan, 1943 (non Carsey, 1926), Jour. Paleontology, vol. 17, p. 486, pl. 77, figs. 5–9.
—— *yatsushiroensis* Murata, **225,** p. 96, pl. 1, fig. 1. Miocene, Japan.
THALMANNAMMINA gen. nov. Pokorny, **262,** p. 469. New genus of family Lituolidae. Genotype: *Haplophragmium subturbinatum* Grzybowsky, 1897, Rozpr. Akad. Umiej. Krakow, vol. 33, p. 280, pl. 10, fig. 23. Upper Cretaceous to Eocene.
Thurammina minuscula Pokorny, **260,** p. 2, pl. 1, fig. 1. Middle Devonian, Czechoslovakia.
Tolypammina glareosa Tappan, **309,** p. 8, pl 2, figs. 1, 2. Upper Triassic, Alaska.
Triplasia emslandensis emslandensis Bartenstein and Brand, **33,** p. 274, pl. 3, figs. 65–67. Lower Cretaceous (upper Valanginian), N.W. Germany.
—— —— *acuta* Bartenstein and Brand, **33,** p. 274, pl. 3, fig. 68. Lower Cretaceous (upper Valanginian), N.W. Germany.
—— *pseudoroemeri* Bartenstein and Brand, **33,** p. 274, pl. 3, fig. 69; pl. 13, fig. 362. Lower Cretaceous (upper Valanginian), N.W. Germany.
Tritaxia mitrata Israelsky, **166,** p. 16, pl. 5, figs. 17–20. Paleocene-Eocene (Lodo formation). California, U.S.A.
Trochammina contorta Tappan, **309,** p. 9, pl. 1, figs. 4–6. Upper Triassic, Alaska.
—— *helicta* Tappan, **309,** p. 9, pl. 1, figs. 7–9. Upper Triassic, Alaska.
—— *nobensis* Asano, **19,** p. 9, figs. 3, 4. Miocene, Japan.
Trochamminoides vertens Tappan, **309,** p. 8, pl. 2, figs. 3, 4. Upper Triassic, Alaska.
Trocholina infragranulata Noth, **241,** p. 69, pl. 1, fig. 32. Lower Cretaceous (Hauterivian), Austria.
Vaginulina duestensis Bartenstein and Brand, **33,** p. 292, pl. 6, figs. 151, 152, 154; 333; pl. 13, fig. 347. Lower Cretaceous (upper Valanginian), N.W. Germany.
—— *echinata* Harris and Jobe, **144,** p. 26, pl. 5, figs. 10, 11. Paleocene, Arkansas, U.S.A.
—— *loeblichi* McLean, **213,** p. 26, pl. 4, figs. 8, 9. Paleocene, North Carolina, U.S.A.
—— *mimataensis* nom. nov. Asano, **22,** p. 15, text fig. 76. Pliocene, Japan. New name for: *Vaginulina tibaensis* Asano, 1938, var. *striata* Asano, 1938, Sci. Rept. Tohoku Imp. Univ., ser. 2, vol. 19, No. 2, p. 208, pl. 17, fig. 6 (non *Vaginulina striata* Costa, 1856, Atti Accad. Pont., vol. 7, fasc. 2, p. 182, pl. 16, fig. 16).
—— *otukai* Uchio, **331,** p. 370, fig. 4. Middle Miocene, Japan.
—— *riedeli riedeli* Bartenstein and Brand, **33,** p. 295, pl. 7, fig. 165. Lower Cretaceous (upper Valanginian), California, U.S.A.
—— —— *paucicostata* Bartenstein and Brand, **33,** p. 295, pl. 7, figs. 166, 167. Lower Cretaceous (upper Valanginian), N.W. Germany. (Note: Varietal name preoccupied by *Vaginulina paucicostata* Reuss, 1862, Sitzber. k. Akad. Wiss. Wien, vol. 46, pt. 1, p. 52, pl. 4, fig. 8. Will be renamed: *V. riedeli* subsp. *delicatocostata* nom. nov. by the authors, according to letter, dated April 1, 1952.)
—— *thoerenensis* Bartenstein and Brand, **33,** p. 296, pl. 7, fig. 170. Lower Cretaceous (upper Valanginian), N.W. Germany.
—— *yoshihamaensis* Inoue and Nakaseko, **164,** p. 10, text fig. 2. Middle Miocene, Japan.
Vaginulinopsis acrulus Tappan, **309,** p. 10, pl. 3, figs. 21–23. Upper Triassic, Alaska.
—— see also *Lenticulina.*

Vagocibicides nipponicus Uchio, **332,** p. 41, pl. 3, fig. 8. Upper Pliocene, Japan.

VALVOBIFARINA gen. nov. Hofker, 154, p. 39. New genus of family Valvulinidae. Genotype: not properly designated by Hofker, given as "*Valvobifarina mackinnoni* (Millet, sic!)." Here designated as: *Bifarina mackinnonii* Millett, 1900, Jour. Roy. Micr. Soc., p. 281, pl. 2, fig. 15. Recent, Malay Archipelago. Age: not given by Hofker, apparently Recent.

VALVOPAVONINA gen. nov. Hofker, 154, p. 35. New genus of family Valvulinidae. Genotype not properly designated by Hofker, given simply as "*Pavonina flabelliformis* (d'Orbigny)," here designated as: *Pavonina flabelliformis* d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 260, pl. 10, figs. 10, 11. Recent.

VALVOTEXTULARIA gen. nov. Hofker, **154,** p. 30. New genus of family Valvulinidae. Genotype: not properly designated by Hofker, as "*Valvotextularia catenata* (Cushman) from the West Indian area." (Note: The type species comes from the western Pacific Ocean, and the compiler is unaware of a figured or described *Textularia catenata* Cushman, 1911, from the West Indian area.) Age: not given, probably Recent.

Valvulineria compressa Stone, **303,** p. 9, pl. 2, fig. 1. Middle Eocene, Peru.

—— *eocenica* Cushman and Stainforth, **76,** p. 158, pl. 27, fig. 19. Upper Eocene, Ecuador.

—— *japonica* Asano, **21,** p. 7, figs. 49–51. Pliocene, Japan.

—— *laevigata* Phleger and F. L. Parker, **257,** p. 25, pl. 13, figs. 11, 12. Recent, N.W. Gulf of Mexico. For: *Eponides exigua* Cushman, 1931 (non *Pulvinulina exigua* Brady, 1884), U. S. Nat. Mus., Bull. 104, pt. 8, p. 44, pl. 10, fig. 1, 2; and for: *Valvulineria* sp. F. L. Parker, 1948, Mus. Comp. Zool., Harvard, Bull., vol. 100, no. 2, p. 240, pl. 4, fig. 13.

—— *menloensis* Rau, **267,** p. 446, pl. 66, figs. 17–22. Oligo-Miocene, Washington, U.S.A.

—— *midwayensis* Harris and Jobe, **144,** p. 46, pl. 8, figs. 16, 17. Paleocene, Arkansas, U.S.A. For: *Anomalina* sp. cf. *A. ammonoides* Kline, 1943, Mississippi State Geol. Surv., Bull. 53, p. 60, pl. 7, figs. 24–26.

—— *nonionoides* Bandy, **27,** p. 504, pl. 74, fig. 5. Upper Cretaceous (Campanian), California, U.S.A. For: *Valvulineria* cf. *V. umbilicatula* in Cushman, 1931, Tennessee Geol. Surv. Bull. 41, p. 53, pl. 9, fig. 5 (only); and for: same species in Cushman and Deaderick, 1944, Jour. Paleontology, vol. 18, p. 339, pl. 53, figs. 17, 18.

—— *peruviana* Cushman and Stone, 1947, var. *discrepans* Cushman and Stainforth, **76,** p. 157, pl. 27, fig. 18. Upper Eocene, Ecuador.

—— *sadonica* Asano, **21,** p. 8, figs. 55–57. Pliocene, Japan.

—— *willapaensis* Rau, **267,** p. 447, pl. 66, figs. 23–25. Middle Oligocene, Washington, U.S.A.

VASICEKIA gen. nov. Pokorny, **260,** p. 11. New genus of family Rheophacidae. Genotype: *Vasicekia moravica* Pokorny, 1951, ut infra. Middle Devonian.

—— *moravica* Pokorny, **260,** p. 11, pl. 1, figs. 8, 9. text figs. 8–12. Middle Devonian (Givetian), Czechoslovakia. For: *Lagena* sp. Bartenstein, 1937, Senckenbergiana, vol. 19, p. 336, text figs. 1, 4; and for *Hyperammina* sp. Bartenstein, 1937, loc. cit., p. 336, text fig. 2a–f.

Verneuilina frustrata Israelsky, **166,** p. 15, pl. 5, figs. 7–13. Paleocene-Eocene (Lodo formation), California, U.S.A.

Verneuilinoides inaequalis Bartenstein and Brand, **33,** p. 276, pl. 13, fig. 348. Lower Cretaceous (middle Valanginian), N.W. Germany.

Virgulina spinicostata Phleger and F. L. Parker, **257,** p. 19, pl. 9, figs. 11–14. Recent, N.W. Gulf of Mexico, 31 meters.

—— *tessellata* Phleger and F. L. Parker, **257,** p. 19, pl. 9, figs. 15, 16. Recent, N.W. Gulf of Mexico.

Vulvulina fortelabiata Israelsky, **166,** p. 14, pl. 4, figs. 17–19. Paleocene-Eocene (Lodo formation), California, U.S.A.

HOMONYMS IN 1952

Allomorphina pacifica Hofker, **154,** p. 139, text fig. 86, Recent, Indonesia, preoccupied by Cushman and Todd, 1949, Cushman Lab. Foram. Res., Contr. vol. 25, p. 68, pl. 12, figs. 6–9, Pliocene, Fiji Islands. Renamed: *Allomorphina fragilis* nom. nov. Hofker, 1952. Cushman Found. Foram. Res., Contr., vol. 3, p. 14.

Bolivina simplex Phleger and F. L. Parker, **257,** p. 14, pl. 7, figs. 4–6, Recent, N.W. Gulf of Mexico, preoccupied by Cushman and H. H. Renz, 1941, Cushman Lab. Foram. Res., Contr., vol. 17, p. 20, pl. 3, fig. 15, Miocene, Venezuela. Renamed: *Bolivina ordinaria* nom. nov. Phleger and F. L. Parker, 1952. Cushman Found. Foram. Res., Contr., vol. 3, p. 14.

Cibicides robustus Phleger and F. L. Parker, **257,** p. 31, pl. 17, figs. 1–4, Recent, N.W. Gulf of Mexico, preoccupied by Le Calvez, 1949, Mém. Explic. Carte géol. dét. France, p. 47, pl. 4, figs. 57–59, Lutetian, France. Renamed: *Cibicides corpulentus* nom. nov. Phleger and F. L. Parker, 1952, Cushman Found. Foram. Res. Contr., vol. 3, p. 14.

CONORBIS gen. nov. Hofker, **154,** p. 418. Lower Cretaceous, preoccupied by Swainson, 1840, Treat. Malacol., p. 149 (Mollusca). Renamed: *CONORBOIDES* nom. nov. Hofker, 1952, Cushman Found. Foram. Res., Contr., vol. 3, p. 14.

?Cornuspira primitiva Bartenstein and Brand, **33,** p. 279, pl. 4, fig. 90, Lower Cretaceous, N.W. Germany, preoccupied by: Rhumbler, 1903, Arch. Protistenkunde, vol. 3, p. 285, text fig. 136, Recent. According to letter of April 1, 1952 the authors will change the name to: *?Cornuspira subprimitiva* nom. nov.

Frondicularia frankei Cushman, 1936, var. *costata* Harris and Jobe, **144,** p. 29, pl. 6, fig. 2, Paleocene, Arkansas, preoccupied by *Frondicularia costata* Kübler and Zwingli, 1866, Neujahrsbl. Bürgersbibl. Winterthur, p. 8, pl. 1, fig. 1, Jurassic, Switzerland; and by: *F. inaequalis* Costa, 1857 var. *costata* A. Silvestri, 1896, Pont. Accad. N. Lincei, Mem., vol. 12, p. 187, pl.6, figs. 28–31 (a new varietal name,

herewith proposed: *silvestriana* nom. nov. Thalmann, 1952). According to letter of June 16, 1952, the authors intend to change their homonym to: *Frondicularia surfibrata* nom. nov.

Listerella minuta Hofker, **154**, p. 27, text fig. 6, Recent, Indonesia, preoccupied by Hussey, 1949, Jour. Paleontology, vol. 23, p. 119, pl. 26, fig. 2, Middle Eocene, Louisiana (later assigned to *Schenckiella*). Renamed: *Schenckiella exigua* nom. nov. (Hofker), Contr. Cushman Found. Foram. Res., vol. 3, 1952, p. 14.

Loxostomum truncatum Phleger and F. L. Parker, **257**, p. 17, pl. 7, figs. 15–19, Recent, N.W. Gulf of Mexico, preoccupied by Finlay, 1947, New Zealand Jour. Sci. and Technol., vol. 28, sect. B, p. 280, pl. 6, figs. 91–96, Middle Miocene, New Zealand. Renamed: *Loxostomum abruptum* nom. nov. Phleger and F. L. Parker, 1952, Cushman Found. Foram. Res., Contr., vol. 3, p. 14.

Nummulites subramondi de la Harpe 1883, subsp. *major* Schaub, **286**, p. 130, text figs. 128–132, pl. 3, nrs. 10, 11, upper Ypresian, Switzerland, preoccupied by *Nummulina* (*Paronaea*) *wemmelensis* de la Harpe and van den Broeck var. *major* Grönwald, 1927, in Sven Hedin, Routenaufn. Ost-Persien, Bd. 2, p. 469, pl. 1, figs. 18–34; and by: *Nummulina discorbina* (Schlotheim, 1820) var. *major* Rozlosznik, 1929, Studien über Nummulinen, p. 123, pl. 6, figs. 16 and 25 (here renamed var. *rozloszniki* nov. var. Thalmann, 1952). Schaub's homonym has not yet been renamed.

Polymorphina palmaris Harris and Jobe, 1951, var. *parallela* Harris and Jobe, 1951, **144**, p. 34, pl. 7, fig. 1, Paleocene, Arkansas, preoccupied by *P. regularis* Münster, 1838, var. *parallela* Millett, 1895, Roy. Geol. Soc. Cornwall, Trans., p. 658, figs. 5, 6. Pliocene, England. To be renamed: *Polymorphina undacuneata* nom. nov. according to letter from R. W. Harris, dated June 16, 1952.

Reophax minutissima Bartenstein and Brand, **33**, p. 266, pl. 1, fig. 12, middle Valanginian, N.W. Germany, preoccupied by Plummer, 1945, Univ. Texas Bull. 4401, p. 230, pl. 17, figs. 25–30, Pennsylvanian, Texas. To be renamed *Reophax neominutissima* nom. nov. by their authors, according to letter of April 1, 1952.

—— *sabulosus* Harris and Jobe, **144**, p. 5, pl. 1, fig. 3, Paleocene, Arkansas, preoccupied by Brady, 1881, Quart. Jour. Micr. Sci., vol. 21, p. 49 (figured in Brady, 1884, Voyage "Challenger," Repts., Zool., vol. 9, pl. 298, pl. 32, figs. 5, 6. According to letter of June 16, 1952, this homonym will be renamed: *Reophax hempsteadensis* nom. nov.

Robulus clericii (Fornasini, 1901) var. *carinata* Marks, **204**, p. 42, pl. 5, fig. 9, Middle Miocene, Austria, preoccupied by *Robulina carinata* Dunikowski, 1879, Kosmos, Lemberg, vol. 4, p. 128, pl. 21, Not yet renamed.

—— *incisus* Lys, 1951, var. *evolutus* Lys, **199**, p. 94, pl. 1, fig. 3, Paleocene, Senegal, preoccupied by *Robulus evolutus* LeRoy, 1941, Colorado School of Mines, Quart., vol. 35, p. 73, pl. 7, figs. 26, 27, Mio-Pliocene, Siberut Island. According to letter from M. Lys, dated August 28, 1951, this varietal homonym will be changed to: *Robulus incisus* Lys var. *evolvens* nom. nov.

Vaginulina riedeli Bartenstein and Brand, 1951, subsp. *paucicostata* Bartenstein and Brand, **33** p. 295, pl. 7, figs. 166, 167, upper Valanginian, Germany, preoccupied by *Vaginulina paucicostata* Reuss, 1862, Akad. Wiss. Wien. Sitzber., vol. 46, no. 1, p. 52, pl. 4, fig. 8, Cretaceous. To be renamed: *V. riedeli* subsp. *delicatocostata* nom. nov. by the authors, according to letter, dated April 1, 1952.

For other homonyms see Addenda for 1951.

SUPPLEMENTARY HOMONYM 1948

Nummulites intermedius Archaic, 1846, var. *crassa* Doncieux, **362**, p. 21, pl. 5, figs. 17–22, Oligocene, Madagascar, preoccupied by *Nummulina crassa* Boubée, 1833, Bull. Hist. Nat. France, ser. 5, no. 7, p. 6; figured in Archiac, 1846, Mém. Soc. géol. France, ser. 2, vol. 3, 415, pl. 9, fig. 12-B. (Note: Another homonym is *Nummulites budensis* Hantken, 1875, var. *crassa* A. Silvestri, 1942, here renamed: *Nummulites budensis* Hantken, 1875, var. *silvestriana* nom. nov. see: Index of Foraminifera, Supplement for 1948, ut infra.)

SUPPLEMENTARY HOMONYMS 1950

Ammodiscus tenuissimus Reitlinger, 1950, Akad. Nauk, S.S.S.R., Trudy Inst. Geol. Nauk, fasc. 126, p. 14, pl. 2, figs. 5, 6, Middle Carboniferous, Moscow region, Soviet Russia, preoccupied by Grzybowsky, 1897, Rozpr. Akad. Umiej Krakow., vol. 33, p. 282, pl. 10, fig. 33, Eocene, Galicia.

Bradyina samarica Reitlinger, 1950, var. *grandis* Reitlinger, 1950, loc. cit., p. 43, pl. 8, figs. 5, 6, Middle Carboniferous, Moscow region, Soviet Russia, preoccupied by *Bradyina grandis* Liebus, 1932, Preuss. Geol. Landes-Anst., Abhandl., N. F. Heft 141, p. 168, pl. 10, figs. 19, 20, Lower Carboniferous, Germany.

Endothyra bradyi Mikhailov, 1939, var. *simplex*, Reitlinger, 1950, loc. cit., p. 31, pl. 6, figs. 1, 2, preoccupied by *Endothyra simplex* Gümbel, 1878, Deutsch-Oesterr. Alpen-Ver., Zeitschr., Beil., Teil 1, p. 105, pl. 25, No. 19, Permian, Tirol, Austria.

GLOMOSPIRELLA gen. nov. Reitlinger, 1950, loc. cit., p. 27, a new genus of family Ammodiscidae, subfamily Glomospirellinae Reitlinger, 1950, Middle Carboniferous, preoccupied by Plummer, 1945, Univ. Texas Bull. 4401, p. 233, Lower and Middle Pennsylvanian. (Note: Reitlinger's new subfamily Glomospirellininae must be changed according to the proposed nom. nov. for the homonymous genus.)

Textularia angusta Reitlinger, 1950, loc. cit., p. 50, pl. 9, fig. 16; pl. 22, fig. 2, Middle Carboniferous, Soviet Russia, preoccupied by Terquem, 1866, Sixième Mém. Foram. Lias, p. 527, pl. 22, fig. 22.

—— —— —— var. *elongata* Reitlinger, 1950, loc. cit., p. 50, pl. 9, fig. 9; pl. 10, fig. 2, preoccupied by Cornuel, 1848, Mém. Soc. géol.

France, ser. 2, vol. 3, p. 258, pl. 2, fig. 25; furthermore by Jones, 1850, Ehrenberg, 1873, Hantken, 1876, and a varietal name by Toula, 1900 and Davis, 1941.

—— *ponderosa* Reitlinger, 1950, loc. cit., p. 54, pl. 11, fig. 5, Middle Carboniferous, Soviet Russia, preoccupied by Fornasini, 1887, Boll. Soc. Geol. Italiana, vol. 6, p. 399, pl. 11, figs. 5, 6.

TURRISPIRA gen. nov. Reitlinger, 1950, loc. cit., p. 18. New genus of family Ammodiscidae, subfamily Ammodiscinae, Middle Carboniferous, preoccupied by Conrad, 1866 Smithson. Misc. Coll., vol. 7, no. 200, p. 19, Mollusca; and by Petho, 1906.

NOMINA NUDA 1951

The following nomina nuda were encountered in the literature on the Foraminifera for the year 1951:

Ammodiscus sp. *hiltermanni* i.n. Kremp, **182,** p. 156, pl. B, figs. 4, 5,

—— sp. *labilatus* i.n. Kremp, **182,** p. 156, pl. B, fig. 6,

Hyperammina sp. *branchia* i.n. Kremp, **182,** pl. C, fig. 1, and

—— sp. *concava* i.n. Kremp, **182,** p. 158, pl. C, fig. 2,

all from Upper Carboniferous (Westfalian) of Germany.

NOTE REGARDING NEW FAMILIES 1951

Hofker, **154,** introduces several families, which might be new:

Alabaminidae Hofker, **154,** p. 389.
Bolivinidae Hofker, **154,** p. 48.
Buliminellidae Hofker, **154,** p. 121.
Cibicidae (recte: Cibicididae) Hofker, **154,** p. 332.
Epistominidae Hofker, **154,** p. 371.
Eponidae (recte: Eponididae) Hofker, **154,** p. 321.
Pulvinulinidae Hofker, **154,** p. 448 (Note: the author disregards the fact that *Eponides* Montfort, 1808 has priority over *Pulvinulina* Parker and Jones, 1862).
Robertinidae Hofker, **154,** p. 379.
Valvulinidae Hofker, **154,** p. 17.
Valvulineridae (recte: Valvulineriidae) Hofker, **154,** p. 484.
Virgulinidae Hofker, **154,** p. 236.

On account of renaming *CONORBOIDES* Hofker, 1952, for *CONORBIS* Hofker, 1951, ut supra (non *Conorbis* Swainson, 1840) the family name has to be changed accordingly to Conorboididae nom. nov.

FORMS WITH NOMENCLATURA APERTA 1951

Alveolina sp. Grekoff and Gubler, **129,** p. 288, pl. 3, figs. 10, 11, Eocene, New Caledonia.

Alveolina (? Flosculina) sp. Vialli, **342,** p. 138, pl. 6, fig. 32. Lower Lutetian, Italy.

Ammobaculites sp. 1 Bartenstein and Brand, **33,** p. 270, pl. 2, fig. 39, Lower Cretaceous, Germany.

—— sp. 2 Bartenstein and Brand, **33,** p. 271, pl. 2, fig. 45. Lower Cretaceous, Germany.

——? sp. A Israelsky, **166,** pl. 12, pl. 2, figs. 36–38; pl. 3, figs. 1–4. Paleocene-Eocene, California.

Ammosphaeroidina? sp. Israelsky, **166,** p. 15, pl. 4, figs. 29–31. Paleocene-Eocene, California.

Amphistegina sp. Grekoff and Gubler, **129,** p. 288, pl. 1, fig. 2-a. Eocene, New Caledonia.

Anomalina sp. Marks, **204,** p. 71, pl. 8, fig. 5. Miocene, Austria.

——? sp. Rau, **267,** p. 451, pl. 67, figs. 11–13. Oligo-Miocene, Washington.

Assilina sp. Grekoff and Gubler, **129,** p. 290, pl. 3, fig. 6. Eocene, New Caledonia.

Austrotrillina sp. Grekoff and Gubler, **129,** p. 291, pl. 4, figs. 18, 19. Eocene, New Caledonia.

Bathysiphon sp. A Israelsky, **166,** p. 5, pl. 2, figs. 5, 6. Paleocene-Eocene, California.

—— sp. B Israelsky, **166,** p. 5, pl. 2, figs. 7–9. Paleocene-Eocene, California.

—— sp. Vasicek, **334,** p. 99, text figs. 4–6. Miocene, Moravia.

Biplanispira sp. Grekoff and Gubler, **129,** p. 290, pl. 3, fig. 15. Eocene, New Caledonia.

Bolivina sp. Phleger and Parker, **257,** p. 15, pl. 7, fig. 20. Recent, Gulf of Mexico.

—— sp. 1 Voorthuysen, **347,** pl. 1, fig. 31. Recent, Netherlands.

—— sp. 2 Voorthuysen, **347,** pl. 1, fig. 32. Recent, Netherlands.

—— sp. A Cushman, **75,** p. 43, pl. 12, fig. 16. Paleocene, Alabama.

—— sp. B Cushman, **75,** p. 43, pl. 12, fig. 17. Paleocene, Alabama.

Bulimina sp. Rau, **267,** p. 442, pl. 65, fig. 17. Oligo-Miocene, Washington.

—— sp. Voorthuysen, **347,** pl. 1, fig. 25. Recent, Netherlands.

Buliminella spec. Hofker, **154,** p. 123, text figs. 75, 76. Upper Cretaceous, Bohemia.

Bullopora sp. Bartenstein and Brand, **33,** p. 321, pl. 11, fig. 298. Lower Cretaceous, Germany.

Carpenteria sp. Grekoff and Gubler, **129,** p. 291, pl. 4, fig. 22. Miocene, New Caledonia.

Chapmania (recte: *Chapmanina*) sp. Daci, **80,** pl. 5, figs. 7, 8. Eocene, Turkey.

Cibicides sp. 1 Phleger and Parker, **257,** p. 32, pl. 17, figs. 10, 11. Recent, Gulf of Mexico.

—— sp. 2 Phleger and Parker, **257,** p. 32, pl. 18, figs. 1–2. Recent, Gulf of Mexico.

—— sp. 1 Voorthuysen, **347,** pl. 2, fig. 13. Recent, Netherlands.

—— n. sp. Young, **359,** p. 67, pl. 14, figs. 30–32. Upper Cretaceous, Montana.

Clavulinoides n. sp. Young, **359,** p. 49, pl. 11, figs. 7, 8. Upper Cretaceous, Montana.

—— sp. A Israelsky, **166,** p. 20, pl. 8, figs. 16–23. Paleocene-Eocene, California.

Conotrochammina sp. A Israelsky, **166,** p. 15, pl. 5, figs. 1–3. Paleocene-Eocene, California.

Dentalina sp. A Cushman, **75,** p. 22, pl. 6, fig. 39. Paleocene, Gulf Coast U.S.A.

—— sp. 1 Bartenstein and Brand, **33,** p. 311, pl. 10, fig. 243. Lower Cretaceous, Germany.

—— sp. 2 Bartenstein and Brand, **33,** p. 310, pl. 9, fig. 238. Lower Cretaceous, Germany.
——? sp. Rau, **267,** p. 434, pl. 64, fig. 29. Oligocene, Washington.
Discocyclina sp. Daci, **80,** pl. 4, figs. 2, 3. Eocene, Turkey.
—— sp. Grekoff and Gubler, **129,** p. 287, pl. 1, figs. 1, 3; pl. 2, fig. 6. Eocene, New Caledonia.
Discorbis sp. 1 Voorthuysen, **347,** pl. 2, fig 4. Recent, Netherlands.
—— sp. 2 Voorthuysen, **347,** pl. 2, fig. 7. Recent, Netherlands.
Dorothia sp. A Israelsky, **166,** p. 22, pl. 9, figs. 16–21; pl. 11, fig. 29. Paleocene-Eocene, California.
—— sp. B Israelsky, **166,** p. 22, pl. 9, figs. 27–29. Paleocene-Eocene, California.
—— sp. C Israelsky, **166,** p. 23, pl. 9, figs. 30–32; pl. 11, figs. 25–28. Paleocene-Eocene, California.
Ehrenbergina sp. Phleger and Parker, **257,** p. 28, pl. 15, figs. 2, 3. Recent, Gulf of Mexico.
—— sp. Takayanagi, **308,** p. 92, text fig. 18. Miocene, Japan.
Ellipsonodosaria curvatura Cushman, 1939, var. A Cushman and Stainforth, **76,** p. 157, pl. 27, fig. 1. Eocene, Ecuador.
—— sp. A Cushman and Stainforth, **76,** p. 157, pl. 27, fig. 7. Eocene, Ecuador.
—— sp. B Cushman and Stainforth, **76,** p. 157, pl. 27, fig. 8. Eocene, Ecuador.
——? sp. Cushman and Stainforth, **76,** p. 157, pl. 27, figs. 5, 6. Eocene, Ecuador.
Elphidium gunteri Cole var. A Voorthuysen, **348,** p. 270, text fig. 7. Holocene, Netherlands.
—— sp. 1 Voorthuysen, **347,** pl. 2, fig. 19. Recent, Netherlands.
—— sp. 1 Voorthuysen, **348,** p. 270, text fig. 6. Holocene, Netherlands.
Entosolenia sp. Cushman, **75,** p. 42, pl. 12, fig. 7. Paleocene, Alabama.
Eouvigerina sp. Voorhuysen, **347,** pl. 2, fig. 20. Reworked (Upper Cretaceous) in Recent. Netherlands.
Fabiania sp. Grekoff and Gubler, **129,** p. 288, pl. 2, fig. 5. Eocene, New Caledonia.
—— sp. Grekoff and Gubler, **129,** p. 291, pl. 4, fig. 23. Miocene, New Caledonia.
Fissurina sp. Voorthuysen, **347,** pl. 1, fig. 18. Recent, Netherlands.
Flabellinella sp. Bartenstein and Brand, **33,** p. 302, pl. 8, fig. 198. Lower Cretaceous, Germany.
Frankeina sp. A Israelsky, **166,** p. 12, pl. 3, figs. 5–8. Paleocene-Eocene, California.
Frondicularia n. sp. 1 Young, **359,** p. 62, pl. 13, 13, figs. 7, 8. Upper Cretaceous, Montana.
—— n.sp. 2 Young, **359,** p. 62, pl. 13, fig. 10. Upper Cretaceous, Montana.
—— sp. 1 Bartenstein and Brand, **33,** p. 307, pl. 9, fig. 217. Lower Cretaceous, Germany.
—— sp. 2 Bartenstein and Brand, **33,** p. 307, pl. 9, fig. 218. Lower Cretaceous, Germany.
Fusulina n.sp Thompson, **321,** p. 86, pl. 9, fig. 2. Paleozoic, New Mexico.
Gaudryina sp. Noth, **241,** p. 36, pl. 4, fig. 9. Middle Cretaceous, Austria.
—— (*Pseudogaudryina*) sp. A Israelsky, **166,** p. 17, pl. 6, figs. 28–32. Paleocene-Eocene, California.
Globigerina sp. Voorhuysen, **347,** pl. 2, fig. 10. Reworked or Recent, Netherlands.
Globivalvulina sp. Sellier de Civrieux, **288,** p. 144, pl. with 5 sections. Permian, Venezuela.
Globulina sp. Bartenstein and Brand, **33,** p. 320, pl. 10, fig. 287. Lower Cretaceous, Germany.
Goesella sp. A Israelsky, **166,** p. 24, pl. 9, figs. 39, 40; pl. 10, figs. 1, 2. Paleocene-Eocene, California.
Gümbelina sp. Young, **359,** p. 63, pl. 14, fig. 11. Upper Cretaceous, Montana.
Gyroidina sp. Young, **359,** p. 65, pl. 14, figs. 14–16. Upper Cretaceous, Montana.
Haplophragmoides sp. Colom, **69,** pl. 7, fig. 1. Eocene, Spain.
—— sp. Vasicek, **334,** p. 99, text figs. 1–3. Miocene, Moravia.
Heterostegina sp. Daci, **80,** pl. 3, figs. 14, 15. Eocene, Turkey.
Hyperammina sp. Lipparini, **192,** p. 151, figs. 2, 3. Oligocene, Italy.
Karreriella sp. Colom, **69,** pl. 2, fig. 7. Eocene, Spain.
Labrospira sp. Phleger and Parker, **257,** p. 3, pl. 1, fig. 14. Recent, Gulf of Mexico.
Lagena sp. Cushman and Stainforth, **76,** p. 148, pl. 26, fig. 15. Eocene, Ecuador.
—— sp. Noth, **241,** p. 60, pl. 6, fig. 32. Upper Cretaceous, Austria.
—— sp. 1 Bartenstein and Brand, **33,** p. 319, pl. 13, fig. 350. Lower Cretaceous, Germany.
—— sp. 2 Bartenstein and Brand, **33,** p. 319, pl. 13, fig. 351. Lower Cretaceous, German.
—— sp. 3 (*?Tristix* sp.) Bartenstein and Brand, **33,** p. 319, pl. 13, fig. 357. Lower Cretaceous, Germany.
—— sp. 4 Bartenstein and Brand, **33,** p. 320, pl. 13, fig. 358. Lower Cretaceous, Germany.
Lenticulina sp. Voorthuysen, **347,** pl. 1, fig. 22. Recent, Netherlands.
—— n.sp. Young, **359,** p. 50, text fig. 5-1. Cretaceous, Montana.
—— (*Saracenaria*) sp. Bartenstein and Brand, **33,** p. 291, pl. 6, fig. 150. Lower Cretaceous, Germany.
—— (*Vaginulina*) sp. = D 35 Hecht, Noth, **241,** p. 50, pl. 1, figs. 14, 16. Lower Cretaceous, Austria.
—— (*Vaginulinopsis*) sp. Noth, **241,** p. 46, pl. 8, fig. 3. Upper Cretaceous, Austria.
Lepidocyclina sp. A Raadshooven, **265,** p. 482, pl. 1, fig. 6; pl. 2, figs. 1, 3, 4; pl. 3, fig. 1; text fig. K-1. Eocene, Venezuela.
—— sp. B Raadshooven, **265,** p. 482, pl. 1, fig. 7; pl. 2, figs. 2, 5, 6; pl. 3, fig. 2; text figs. m, n. Eocene, Venezuela.
Lingulina sp. 1 Bartenstein and Brand, **33,** p. 300, pl. 8, fig. 191. Lower Cretaceous, Germany.
—— sp. 2 Bartenstein and Brand, **33,** p. 301, pl. 8, fig. 192. Lower Cretaceous, Germany.
—— sp. 3 Bartenstein and Brand, **33,** p. 301, pl. 8, fig. 193. Lower Cretaceous, Germany.
—— sp. 4 Bartenstein and Brand, **33,** p. 299, pl. 8, fig. 186. Lower Cretaceous, Germany.

Lituotuba sp. Bartenstein and Brand, **33,** p. 267, pl. 1, fig. 17. Lower Cretaceous, Germany.
Marginopora sp. Drooger, **93,** p. 59, text fig. 1-c. Lower Miocene, West Indies.
Marginulina sp. A Cushman, **75,** p. 18, pl. 5, figs. 30, 31. Paleocene, Texas.
—— sp. B Cushman, **75,** p. 18, pl. 5, figs. 32, 33. Paleocene, Arkansas.
Marginulinopsis n.sp. 1 Young, **359,** p. 57, pl. 12, fig. 5; text fig. 6, no. 19. Cretaceous, Montana.
—— n.sp. 2 Young, **359,** p. 57, text fig. 6, Nos. 17, 18. Cretaceous, Montana.
—— n.sp. 3 Young, **359,** p. 58, pl. 11, fig. 16; pl. 12, fig. 7; text fig. 6, no. 1. Cretaceous, Montana.
—— sp. Young, **359,** p. 58, text fig. 5, nos. 5–24, 26, 29, Cretaceous, Montana.
Marssonella sp. A Israelsky, **166,** p. 20, pl. 8, figs. 24–31; pl. 10, figs. 22–25. Paleocene-Eocene, California.
—— sp. Voorthuysen, **347,** pl. 2, fig. 21. Reworked from Upper Cretaceous in Recent, Netherlands.
Nodogenerina sp. Colom, **69,** pl. 2, fig. 8. Eocene, Spain.
—— sp. Cushman and Stainforth, **76,** p. 151, pl. 26, fig. 33. Eocene, Ecuador.
Nodophthalmidium sp. Bartenstein and Brand, **33,** p. 279, pl. 4, fig. 93. Lower Cretaceous, Germany.
Nodosarella sp. Noth, **241,** p. 67, pl. 2, fig. 39; pl. 4, fig. 6. Cretaceous, Austria.
Nodosaria? sp. Loeblich and Tappan, **196,** p. 87, pl. 2, fig. 4. Lower Cretaceous, Texas.
Nodosaria sp. Noth, **241,** p. 55, pl. 2, figs. 21, 22. Cretaceous, Austria.
—— sp. 1 Young, **359,** p. 59, pl. 12, fig. 15; pl. 13, figs. 11, 12. Cretaceous, Montana.
—— sp. 2 Young, **359,** p. 60, pl. 13, fig. 9. Cretaceous, Montana.
——? sp. 3 Young, **359,** p. 60, pl. 12, figs. 16, 18. Cretaceous, Montana.
Nodosaride? O. Wetzel, **354,** p. 114, pl. 14, fig. 2. Uppermost Cretaceous, Denmark.
Nonion sp. Rau, **267,** p. 437, pl. 64, figs. 23, 24. Oligocene, Washington.
Nonionella sp. Cushman, **75,** p. 37, pl. 11, figs. 5, 6. Paleocene, Alabama, For: *Nonionina turgida* Plummer 1926 (non Williamson, 1858), Texas Univ. Bull. 2644, p. 159, pl. 12, fig. 7 (only).
Nummulites burdigalensis de la Harpe, 1926 subsp. a Schaub, **286,** p. 119, pl. 2, figs. Nos. 10–14; pl. 3, fig. No. 6; text figs. 96, 98–10 (transitional form to *N. inkermanensis* Schaub, 1951, ut supra). Lower Eocene, Switzerland.
—— —— —— subsp. b Schaub, **286,** p. 121, pl. 2, figs. Nos. 4, 9; pl. 3, fig. No. 7; text figs. 102–104, 108–110 (transitional form to *N. gallensis* Heim). Lower Eocene, Switzerland.
—— sp. Daci, **80,** p. 224, pl. 2, figs. 13, 14. Eocene, Turkey.
—— sp. Daci, **80,** p. 225, pl. 2, fig. 15. Eocene, Turkey.
—— sp. Daci, **80,** p. 242, pl. 1, figs. 6, 7. Eocene, Turkey.
—— sp. Daci, **80,** p. 243, pl. 2, figs. 10–12. Eocene, Turkey.
—— sp. Grekoff and Gubler, **129,** p. 288, pl. 1, fig. 2-c. Eocene, New Caledonia.
—— sp. Schaub, **286,** p. 162, text fig. 219. Paleocene, Switzerland (transitional form to *N. fraasi-nitidus* A-form).
—— sp. Schaub, **286,** p. 170, text figs. 231, 232. Paleocene-Eocene, Switzerland (transitional form to *N. exilis-planulata*).
—— sp. Schaub, **286,** p. 199, text fig. 298 (A-form). Lower Eocene, Switzerland.
—— sp. Vialli, **342,** p. 125, pl. 6, figs. 4–6. Eocene, Italy.
Operculina sp. Grekoff and Gubler, **129,** p. 290, pl. 3, figs. 12, 13-a. Eocene, New Caledonia.
—— sp. Vialli, **342,** p. 135, pl. 6, fig. 18. Eocene, Italy.
Parafusulina sp. Gonzalez de Juana, **125,** p. 136, text fig. 8. Permo-Carboniferous, Venezuela.
Paratextularia sp. 1 Pokorny, **260,** p. 21, text fig. 16. Middle Devonian, Czechoslovakia.
—— sp. 2 Pokorny, **260,** p. 22, text fig. 17. Middle Devonian, Czechoslovakia.
Pellatispira sp. Grekoff and Gubler, **129,** p. 287, pl. 3, fig. 14. Eocene, New Caledonia.
—— or *Calcarina* sp. Grekoff and Gubler, **129,** p. 290, pl. 3, fig. 14. Eocene, New Caledonia.
Planularia n. sp. Young, **359,** p. 50, pl. 11, figs. 13, 14. Cretaceous, Montana.
—— sp. A Cushman and Stainforth, **76,** p. 147, pl. 25, fig. 44. Eocene, Ecuador.
—— sp. B Cushman and Stainforth, **76,** p. 147, pl. 25, fig. 45. Eocene, Ecuador.
Pleurostomella sp. Noth, **241,** p. 67, pl. 2, fig. 38. Cretaceous, Austria.
Polymorphina sp. Cushman, **75,** p. 35, pl. 10, fig. 7. Paleocene, Alabama.
Polymorphinidae (genus dubium, species dubia) Bartenstein and Brand, **33,** p. 324, pl. 11, figs. 315, 316. Lower Cretaceous, Germany.
?Pullenia sp. Voorthuysen, **347,** pl. 1, fig. 35. Recent, Netherlands.
Pyrulina sp. 1 Bartenstein and Brand, **33,** p. 320, pl. 10, fig. 288. Lower Cretaceous, Germany
—— sp. 2 Bartenstein and Brand, **33,** p. 320, pl. 10, figs. 291, 292. Lower Cretaceous, Germany.
Quinqueloculina sp. Bandy, **27,** p. 491, pl. 72, fig. 1. Cretaceous, California.
—— sp. Colom, **69,** p. 31, text fig. 51. Eocene, Spain.
—— sp. Colom, **69,** p. 31, text fig. 52. Eocene, Spain.
—— sp. Rau, **267,** p. 430, pl. 63, figs. 10, 11. Miocene, Washington.
Ramulina sp. Young, **359,** p. 62, pl. 14, figs. 9, 10. Cretaceous, Montana.
Rectobolivina nov. spec. Hofker, **154,** p. 114, text fig. 67. Recent, Indonesia.
Robulus? sp. Rau, **267,** p. 433, pl. 63, fig. 25. Oligocene, Washington.
Robulus sp. Vialli, **342,** p. 152, pl. 7, figs. 33, 34. Eocene, Italy.
Spirillina sp. Cushman and Stainforth, **76,** p. 157, pl. 27, fig. 11. Eocene, Ecuador.
—— sp. Phleger and Parker, **257,** p. 25, pl. 13, figs. 5, 6. Recent, Gulf of Mexico.
Spiroloculina sp. 1 Voorthuysen, **347,** pl. 1, fig 9. Recent, Netherlands.

Spiroplectammina sp. Cushman and Stainforth, **76,** p. 144, pl. 25, fig. 21. Eocene, Ecuador.
—— sp. Noth, **241,** p. 32, pl. 6, fig. 25. Cretaceous, Austria.
—— sp. A Israelsky, **166,** p. 13, pl. 3, figs. 17–19. Paleocene-Eocene, California.
—— sp. B Israelsky, **166,** p. 13, pl. 3, figs. 15, 16. Paleocene-Eocene, California.
Stensiöina n.sp. Young, **359,** p. 65, pl. 14, figs. 4–8. Cretaceous, Montana.
Textularia sp. Phleger and Parker, **257,** p. 5, pl. 2, figs. 9, 10. Recent, Gulf of Mexico.
—— spp. indet. Israelsky, **166,** p. 14, pl. 3, figs. 32–34. Paleocene-Eocene, California.
Triloculina sp. Colom, **69,** p. 31, fig. 50. Eocene, Spain.
Trochammina sp. A Israelsky, **166,** p. 14, pl. 14, figs. 20–28. Paleocene-Eocene, California.
—— sp. Phleger and Parker, **257,** p. 9, pl. 4, fig. 16. Recent, Gulf of Mexico.
Uvigerina sp. Colom, **69,** p. 31, text fig. 9. Eocene, Spain.
—— sp. Colom, **69,** pl. 2, fig. 1. Eocene, Spain.
—— sp. Colom, **69,** pl. 7, fig. 2. Eocene, Spain.
Vaginulina sp. 1 Bartenstein and Brand, **33,** p. 296, pl. 7, fig. 169. Lower Cretaceous, Germany.
—— sp. 2 Bartenstein and Brand, **33,** p. 296, pl. 7, fig. 336. Lower Cretaceous, Germany.
—— sp. 3 Bartenstein and Brand, **33,** p. 292, pl. 6, fig. 153. Lower Cretaceous, Germany.
—— sp. 4 Bartenstein and Brand, **33,** p. 292, pl. 6, fig. 155. Lower Cretaceous, Germany.
—— n.sp. Young, **359,** p. 60, pl. 13, figs. 13, 14. Cretaceous, Montana.
?Valvulineria sp. Voorthuysen, **347,** pl. 2, fig. 8. Recent, Netherlands.
Verneuilina? sp. Israelsky, **166,** p. 16, pl. 5, figs. 14–16. Paleocene-Eocene, California.

INDEX TO FORAMINIFERA SUPPLEMENT FOR 1948

Allogromia laticollare Arnold, Amer. Micr. Soc., Trans., vol. 67, no. 3, p. 231, text figs. 1–3. Recent, off Florida, U.S.A.
Assilina aspera Doncieux, **362,** p. 25, pl. 6, figs. 15–19 (B-form), figs. 20–25 (A-form). Eocene (Lutetian), Madagascar.
Nummulites besairiei Doncieux, **362,** p. 17, pl. 4, figs. 5–10. Eocene (Lutetian), Madagascar.
—— *bi-apiculatus* Doncieux, **362,** p. 17, pl. 4, figs. 11–19. Eocene (Lutetian), Madagascar.
—— *fichteli* Michelotti, 1841, var. *crassa* Doncieux, **362,** p. 22, pl. 5, figs. 23–25. Oligocene (Stampian), Radama Island, Madagascar. [Note: Variety name preoccupied by *Nummulina crassa* Boubée, 1833, Bull. Hist. Nat. France, ser. 5, no. 7, p. 6; figured by Archiac, 1848, Mém. Soc. géol. France, ser. 2, vol. 3, p. 415, pl. 9, fig. 16–B; and also by *Nummulites budensis* Hantken, 1875, var. *crassa* A. Silvestri, 1942, Paleontogr. Italica, vol. 32, Suppl. 5, p. 20(200), pl. 20, fig. 3, Eocene (Upper Lutetian), Somalia. Silvestri's varietal homonym is herewith renamed: *Nummulites budensis* Hantken, 1875, var. *silvestriana* nom. nov. (see A. Silvestri, 1942, loc. cit. p. 20(200) for synonymy of this variety.]
—— *intermedius* Archaic, 1846 var. *crassa* Doncieux, **362,** p. 21, pl. 5, figs. 17–22. Oligocene (Stampian), Radama Island, Madagascar. (Note: this varietal name is also preoccupied by Boubée, 1833, see preceding entry, ut supra.)
—— *narindaensis* Doncieux, **362,** p. 12, pl. 1, figs. 19–26. Eocene (Lutetian), Madagascar.
—— *uroniensis* (de la Harpe-Heim, 1908) var. *paucigranulata* Doncieux, **362,** p. 16, pl. 3, figs. 12–17; pl. 4, figs. 1–4. Eocene (Lutetian), Madagascar.

SUPPLEMENT FOR 1950

In the Journal of Paleontology, vol. 26, p. 246, a publication by E. A. Reitlinger was mentioned under Lit. No. 622. Thanks to the kindness of S. Boltovskoy (Buenos Aires) the compiler came into possession of this paper, written in Russian, entitled: "Foraminifery srednekamen-nougolnykh otlozhenii Tsentral'noi chasti Russkoi platformy (iskliuchaia sem. Fusulinidae)" Akad. Nauk S.S.S.R., Inst. Geol. Nauk, Trudy, No. 126, geol. ser. No. 47, Moscow, 1950, 127 pp., 22 pls. (practically all thin sections through smaller Foraminifera), 15 text figs., 1 distribution table. The list of the new genera, species, and varieties described and figured by Reitlinger in this publication, all from Middle Carboniferous (unless otherwise stated), together with a few supplements from other papers, follows:

Ammodiscus gigas Reitlinger, Akad. Nauk S.S.S.R., Trudy Inst. Geol. Nauk., fasc. 126, Geol. Ser. No. 47, p. 15, pl. 2, fig. 22.
—— *parvus* Reitlinger, ibid., p. 14, pl. 2, fig. 4.
—— *tenuissimus* Reitlinger, ibid., p. 14, pl. 2, figs. 5, 6. (Note: Preoccupied by Grzybowsky, 1897, Rozpr. Akad. Umiej Krakow., vol. 33, p. 282, pl. 10, fig. 33 for an Eocene species.)
—— *turbulentus* Reitlinger, ibid., p. 15, pl. 2, figs. 10–14.
—— *variabilis* Reitlinger, ibid., p. 14, pl. 2, figs. 16, 17.
Ammovertella delicta Reitlinger, ibid., p. 24, pl. 3, fig. 8.
—— *elegantissima* Reitlinger, ibid., p. 23, pl. 3, fig. 1.
—— *lata* Reitlinger, ibid., p. 23, pl. 3, fig. 2.
—— *vaga* Reitlinger, ibid., p. 24, pl. 3, fig. 11, pl. 21, fig. 6.
Archaediscus karreriformis Reitlinger, ibid., p. 83, pl. 18, figs. 6, 7.
—— *permodiscoides* Reitlinger, ibid., p. 85, pl. 18, fig. 5.
—— *probatus* Reitlinger, ibid., p. 83, pl. 18, fig. 9.
—— *subbashkiricus* Reitlinger, 1949, var. *grandis* Reitlinger, ibid., p. 84, pl. 18, figs. 10, 11
—— *timanicus* Reitlinger var. *minima* Reitlinger, ibid., p. 85, pl. 18, fig. 4.
—— *variabilis* Reitlinger, ibid., p. 86, pl. 18, figs. 1–3.
Bradyina concinna Reitlinger, ibid., p. 39, pl. 8, fig. 7. (Top Namurian and basal Middle Carboniferous.)

—— *eonautiliformis* Reitlinger, ibid., p. 41, pl. 8, fig. 4.
—— *lepida* Reitlinger, ibid., p. 43, pl. 7, figs. 3–6, Top Middle Carboniferous to basal Upper Carboniferous.
—— *minima* Reitlinger, ibid., p. 44, pl. 7, figs. 11, 12.
—— *pauciseptata* Reitlinger, ibid., p. 45, pl. 7, figs. 13–15.
—— *pseudonautiliformis* Reitlinger, ibid., p. 41, pl. 8, figs. 1–3.
—— *samarica* Reitlinger, ibid., p. 42, pl. 7, figs. 16–19.
—— —— —— var. *grandis* Reitlinger, ibid., p. 43, pl. 8, figs. 5, 6. (Note: Varietal name preoccupied by *Bradyina grandis* Liebus, 1932, Abhandl. Preuss. Geol. Landes-Anst., Berlin, N. F. Heft 141, pl. 168, pl. 10, figs. 19, 20, from Lower Carboniferous of Germany.)
—— *venusta* Reitlinger, ibid., p. 44, pl. 7, figs. 7, 8. Lower part Middle Carboniferous.
BRUNSIELLA gen. nov. Reitlinger, ibid., pl. 16. A new genus of family Ammodiscidae, subfamily Ammodiscinae. Genotype: *Glomospira ammodiscoides* Rauser-Chernousova, 1938, Akad. Nauk S.S.S.R., Trudy, Geol. Inst. Moscow, vol. 7, pl. 93, pl. 1, figs. 1–3. Middle Carboniferous (Moscovian).
—— *densa* Reitlinger, ibid., pl. 18, pl. 2, figs. 1–3.
—— —— —— var. *parva* Reitlinger, ibid., pl. 18, pl. 2, figs. 18, 19.
?Clavulina isidrensis Rusconi, **392,** p. 67, text fig. 3. Cambrian, Mendoza, Argentina.
Climacammina aljuvotica Reitlinger, Akad. Nauk. S.S.S.R. Trudy, Inst. Geol. Nauk, fasc. 126, p. 60, pl. 12, figs. 13, 14.
—— *apliatula* Reitlinger, ibid., p. 67, pl. 13, fig. 1.
—— *elegantula* Reitlinger, ibid., p. 60, pl. 9, fig. 8.
—— *fragilis* Reitlinger, ibid., p. 62, pl. 9, figs. 3–5.
—— *grandis* Reitlinger, ibid., p. 66, pl. 14, figs. 2, 4, 5.
—— *ivanovae* Reitlinger, ibid., p. 63, pl. 9, fig. 19.
—— *keltmensis* Reitlinger, ibid., p. 63, pl. 11, fig. 4.
—— *moelleri* Reitlinger, ibid., p. 64, pl. 13, figs. 2, 3.
—— —— —— var. *timanica* Reitlinger, ibid., p. 65, pl. 13, figs. 4–8.
—— *obscura* Reitlinger, ibid., p. 62, pl. 9, figs. 6, 7.
—— *obsoleta* Reitlinger, ibid., p. 64, pl. 11, fig. 8.
—— *procera* Reitlinger, ibid., p. 61, pl. 9, figs. 1, 2.
—— *tenuicribrata* Reitlinger, ibid., p. 61, pl. 9, fig. 19.
Cribrostomum brevis Reitlinger, ibid., p. 57, pl. 10, fig. 3.
—— *posteximium* Reitlinger, ibid., pl. 56, pl. 9, fig. 15.
Deckerella composita Reitlinger, ibid., p. 69, pl. 12, figs. 1, 5.
—— *dvinensis* Reitlinger, ibid., p. 70, pl. 12, fig. 12.
—— *gracilis* Reitlinger, ibid., p. 68, pl. 12, figs. 3, 4.
—— *mjachkovensis* Reitlinger, ibid., p. 69, pl. 12, figs. 6–8.
—— *tenuissima* Reitlinger, ibid., p. 68, pl. 12, figs. 9–11.
DECKERELLINA gen. nov. Reitlinger, ibid., p. 57. New genus of family Textulariidae. Genotype: *Deckerellina istiensis* Reitlinger, 1950, ut infra. Middle Carboniferous (Moscovian).
—— *istiensis* Reitlinger, ibid., p. 58, pl. 10, figs. 6–8, pl. 22, fig. 3.
—— *mirabilis* Reitlinger, ibid., p. 57, pl. 10, figs. 4, 5.
Endothyra aljuvotica Reitlinger, ibid., p. 34, pl. 5, figs. 4–6.
—— *bradyi* Mikhailov, 1939, var. *irregularis* Reitlinger, ibid., p. 32, pl. 7, figs. 2.
—— —— —— var. *simplex* Reitlinger, ibid., p. 31, pl. 6, figs. 1, 2. (Note: Varietal name preoccupied by *Endothyra simplex* Gümbel, 1878, Zeitschr. Deutsch-Oesterreich. Alpen-Verein. Beil., Teil. 1, p. 105, fig. 25, no. 19, Permian, Tirol).
—— *eostaffeloides* Reitlinger, ibid., p. 35, pl. 5, figs. 1–3.
—— —— —— var. *lata* Reitlinger, ibid., p. 36, pl. 8, fig. 1.
—— *inusitata* Reitlinger, ibid., p. 31, pl. 6, figs. 10, 11.
—— *irinae* Reitlinger, ibid., p. 35, pl. 5, figs. 8, 9. (Upper Carboniferous).
—— *minuta* Reitlinger, ibid., p. 32, pl. 5, figs 7, 13.
—— *mosquensis* Reitlinger, ibid., p. 33, pl. 6, figs. 3, 4, 12.
—— *rzhevica* Reitlinger, ibid., p. 33, pl. 6, figs. 7, 8.
—— *siviniensis* Reitlinger, ibid., p. 34, pl. 6, figs. 5, 6. (Upper Carboniferous)
—— *spirilliniformis* Brazhnikova and Potievska, 1948, var. *evoluta* Reitlinger, ibid., p. 36, pl. 6, fig. 9.
Endothyranella mordovica Reitlinger, ibid., p. 38, pl. 5, fig. 10 (Upper Carboniferous).
Globivalvulina granulosa Reitlinger, ibid., p. 80, pl. 17, figs. 4–8.
—— —— —— var. *complicata* Reitlinger, ibid., p. 80, pl. 16, figs. 12, 13.
—— —— —— var. *compressa* Reitlinger, ibid., p. 81, pl. 16, figs. 10, 11.
—— —— —— var. *multiseptata* Reitlinger, ibid., p. 81, pl. 17, fig. 10.
—— *kamensis* Reitlinger, ibid., p. 78, pl. 16, figs. 5, 6.
—— *mosquensis* Reitlinger, ibid., p. 79, pl. 16, figs. 1–4.
—— *pulchra* Reitlinger, ibid., p. 78, pl. 16, fig. 7.
—— *rauserae* Reitlinger, ibid., p. 81, pl. 17, figs. 1–3. (Upper Carboniferous).
—— *syzranica* Reitlinger, ibid., p. 79, pl. 16, figs. 8, 9.
Globotruncana indica Jacob and Sastri, **378,** p. 266, text fig. 2. Upper Cretaceous (Cenomanian), southern India.
Glomospira mikhailovi Reitlinger, Akad. Nauk. S.S.S.R., Trudy, Inst. Geol. Nauk, fasc. 126, p. 21, pl. 3, figs. 2, 3.

—— *pusilliformis* Reitlinger, ibid., p. 20, pl. 3, figs. 3, 4.
GLOMOSPIRELIA gen. nov. Reitlinger, ibid., p. 27, New genus of family Ammodiscidae, subfamily Glomospirellinae, new subfamily, ut infra. Upper part Middle Carboniferous (Moscovian). Genotype: *Glomospirella borealis* Reitlinger, 1950, ut infra. (Note: Preoccupied by *Glomospirella* Plummer, 1945, Univ. Texas Publ. No. 4401, p. 233, with genotype *G., umbilicata* Plummer, 1945, Lower and Middle Pennsylvanian).
—— *biformis* Reitlinger, ibid., p. 27, pl. 21, figs. 4, 5.
—— *borealis* Reitlinger, ibid., p. 27, pl. 4, figs. 3, 4.
Glomospirellinae new subfamily Reitlinger, ibid., p. 26, New subfamily of family Ammodiscidae. Includes the genera *Glomospirella* Reitlinger, 1950, ut supra; and *Glomospiroides*Reitlinger 1950, ut infra. Middle Carboniferous. (Note: Subfamily-name must be renamed in accordance with nom. nov. for *Glomospirella* Reitlinger, 1950 (non Plummer, 1945).
GLOMOSPIROIDES gen. nov., Reitlinger, ibid., p. 28, New genus of family Ammodiscidae, subfamily Glomospirellinae Reitlinger ut supra. Genotype: *Glomospiroides fursenki* Reitlinger, 1950, ut infra. Middle Carboniferous (Moscovian).
—— *fursenki* Reitlinger, ibid., p. 28, pl. 4, figs. 1, 2.
HAPLOPHRAGMINA gen. nov. Reitlinger, ibid., p. 28, New genus of Family Lituolidae, subfamily Haplophragminae. Genotype: *Haplophragmina kashirica* Reitlinger, 1950, ut infra. Middle and Upper Carboniferous.
—— *kashirica* Reitlinger, ibid., p. 29, pl. 4, figs. 5–8.
—— *potensa* Reitlinger, ibid., p. 29, pl. 4, figs. 9, 10. Upper Carboniferous.
Hemigordius simplex Reitlinger, ibid., p. 86, pl 3, fig. 12.
Hyperammina aljuvotica Reitlinger, ibid., p. 13, pl. 3, fig. 10.
Lituotuba regularis Reitlinger, ibid., p. 22, pl. 3, fig. 17.
PALAEONUBECULARIA gen. nov. Reitlinger, ibid., p. 91. Incertae sedis. Genotype: *Palaeonubecularia fluxa* Reitlinger, 1950, ut infra. Middle Carboniferous.
—— *fluxa* Reitlinger, ibid., p. 91, pl. 20, figs. 4, 5.
—— *rustica* Reitlinger, ibid., p. 92, pl. 20, figs. 3, 7.
—— *uniserialis* Reitlinger, ibid., p. 91, pl. 20, figs. 1, 2, 6.
PSEUDOBRADYINA gen. nov. Reitlinger, ibid., p. 45. New genus of family Lituolidae, subfamily Bradyininae. Genotype: *Pseudobradyina pulchra* Reitlinger, 1950, ut infra. Middle and Upper Carboniferous (cave *Pseudobradya* Sars, 1904, a crustacean).
—— *pulchra* Reitlinger, ibid., p. 46, pl. 7, figs. 9, 10, pl. 22, fig. 1.
? Pseudoglandulina alfaensis Rusconi, **392**, p. 68, text fig. 4. Cambrian, Mendoza, Argentina.
Spiroplectammina conspecta Reitlinger, Akad. Nauk. S.S.S.R. Trudy, Inst. Geol. Nauk, fasc. 126, p. 70, pl. 15, figs. 12–16.
SYZRANIA gen. nov. Reitlinger, ibid., p. 92. New genus of incertae sedis. Genotype: *Syzrania bella*, Reitlinger, 1950, ut infra. Upper Carboniferous.
—— *bella* Reitlinger, ibid., p. 92, pl. 21, fig. 1. Upper Carboniferous.
—— *confusa* Reitlinger, ibid., p. 93, pl. 20, figs. 8–10.
Tetrataxis angusta Vissarionova var. *serpukhovensis* Reitlinger, ibid., p. 74, pl. 15, figs. 5, 11.
—— *minima* Lee and Chén, 1930, var. *latispiralis* Reitlinger, ibid., p. 71, pl. 15, fig. 2.
—— —— —— var. *mosquensis* Reitlinger, ibid., p. 72, pl. 15, fig. 9.
—— *numerabilis* Reitlinger, ibid., p. 74, pl. 15, figs. 3, 4.
—— *paraconica* Reitlinger, ibid., p. 75, pl. 15, fig. 1.
—— *planispiralis* Reitlinger, ibid., p. 73, pl. 15, fig. 8.
Textularia angusta Reitlinger, ibid., p. 50, pl. 9, fig. 16, pl. 22, fig. 2. (Note: Species-name preoccupied by Terquem, 1866, Sixieme Mém. Foraminifères du Lias, p. 527, pl. 22, fig. 24.
—— —— —— var. *decurta* Reitlinger, ibid., p. 51, pl. 10, figs. 12, 13, pl. 22, fig. 6.
—— —— —— var. *elongata* Reitlinger, ibid., p. 50, pl. 9, fig. 9, pl. 10, fig. 2 (Varietal name preoccupied by *Textularia elongata* Cornuel, 1838, Mém. Soc. géol. France, ser. 2, vol. 3, p. 258, pl. 2, fig. 25, from Lower Cretaceous; furthermore by Jones, 1850, by Ehrenberg, 1873, by Hantken, 1876; and as varietal name by Toula, 1900 and by Davis, 1941).
—— —— —— var. *maxima* Reitlinger, ibid., p. 50, pl. 10, fig. 9.
—— *bruta* Reitlinger, ibid., p. 55, pl. 11, fig. 6.
—— *eofragilis* Reitlinger, ibid., p. 49, pl. 9, fig. 17.
—— *fragilis* Reitlinger, ibid., p. 52, pl. 10, fig. 1.
—— *gibbosaeformis* Reitlinger, ibid., p. 53, pl. 10, figs. 14–16.
—— *grandis* Reitlinger, ibid., p. 56, pl. 11, figs. 2, 3.
—— *longissima* Reitlinger, ibid., p. 53, pl. 9, fig. 10; pl. 10, fig. 10.
—— *minutissima* Reitlinger, ibid., p. 52, pl. 9, fig. 11.
—— *paracommunis* Reitlinger, ibid., p. 55, pl. 11, figs. 1, 7.
—— *ponderosa* Reitlinger, ibid., p. 54, pl. 11, fig. 5. (Note: Preoccupied by Fornasini, 1887, Boll. Soc. Geol. Italiana, vol., 6, p. 399, pl. 11, figs. 5, 6).
—— *primitiva* Reitlinger, ibid., p. 50, pl. 9, fig. 12.
—— *vulgaris* Reitlinger, ibid., p. 53, pl. 9, figs. 13, 14, pl. 10, fig. 17.
Tolypammina fortis Reitlinger, ibid., p. 26, pl. 3, fig. 6, pl. 21, fig. 7.
—— *complicata* Reitlinger, ibid., p. 25, pl. 3, figs. 15, 16.
Tuberitina collosa Reitlinger, ibid., p. 89, pl. 19, figs. 7–9.

—— —— —— var. *plana* Reitlinger, ibid., p. 89, pl. 19, fig. 1.
—— *crafti* Reitlinger, ibid., p. 112, no description, pl. 1, fig. 3.
—— *maljavkini* Mikhailov, 1939, var. *grandis* Reitlinger, ibid., p. 88, pl. 19, fig. 10.
Tuberitina ? rotundata Reitlinger, ibid., p. 90, pl. 19, fig. 5.
Tuberitina sp. No. 1 Reitlinger, ibid., p. 88, pl. 19, fig. 10.
TURRISPIRA gen. nov. Reitlinger, ibid., pl. 18. New genus of family Ammodiscidae subfamily Ammodiscinae. Genotype: *Turrispira mira* Reitlinger, 1950, ut infra. Middle Carboniferous. (Note: Genus name preoccupied by *Turrispira* Conrad, 1866, Smithson. Miscell. Coll., vol. 7, no. 200, p. 19, Mollusca; and by *Turrispira* Petho, 1906.)
—— *irregularis* Reitlinger, ibid., p. 19, pl. 2, fig. 9.
—— *mira* Reitlinger, ibid., p. 19, pl. 2, figs. 7, 8.

In the Russian text of Reitlinger's publications appear some names of Foraminifera of which the compiler has no record in his card index. They are:

Ammodiscus multivolutus Reitlinger
Archaediscus krestnovikoi Rauser
—— *ovoides* Rauser
—— *postrugosus* Reitlinger
—— *pseudomoelleri* Reitlinger
—— *subbashkiricus* Reitlinger
—— *subcylindricus* Brazhnikova and Potievska
Eostaffella mediocris Vissarionova
Glomospira discoidea Brazhnikova and Potievska
—— *dublicata* Lipina
—— *elegans* Lipina
—— *hemigordiformis* Chernisheva
—— *irregularis* Brazhnikova and Potievska
—— *vulgaris* Lipina
Hyperammina minima Mir.
Pseudostaffella topilini Putrja
Tetrataxis eominima Rauser
Textularia consobrina Lipina
—— *longiseptata* Lipina
Ammovertella minuta Lipina
Bradyina compressa Morozova
—— —— var. *minima* Morozova
Climacammina inperta Reitlinger
—— *prisca* Lipina
Endothyra bradyi Mikhailov, var. *compressa* Reitlinger
—— —— var. *maxima* Brazhnikova and Potievska
—— *spirilliniformis* Brazhnikova and Potievska
—— *spirillinoides* Brazhnikova and Potievska
Globivalvulina eogranulosa Reitlinger
—— *moderata* Reitlinger
—— *parva* Reitlinger
Permodiscus vetustus Chernisheva
Spiroplectammina bashkirica Rauser
Textularia breviseptata Lipina
—— *diversa* Chernisheva

Any micropaleontologist who might have access to the publications in which the abovementioned names have duly been proposed in accordance with the International Rules of Zoological Nomenclature would render a great service to taxonomists by publishing such information.

NOMINA APERTA 1950 (SUPPLEMENT)

Dyocibicides n.sp.(?) Schütznerova-Havelkova, **395**, p. 74, pl. 3, fig. 16. Miocene (Helvetian), Czechoslovakia.
Nodosaria sp. Schütznerova-Havelkova, **395**, p. 38, pl. 3, fig. 6. Miocene (Helvetian), Czechoslovakia.

NOMEN NUDUM 1950 (SUPPLEMENT)

Globotruncana pseudocretacea Nakkady, 1950, Jour. Paleontology, vol. 24, p. 675 (list).

ADDENDA TO BIBLIOGRAPHY

After the manuscript had been sent to the editors the following addenda to the Bibliography and Index of new Foraminifera came to the attention of the compiler:

1947

407. Miklukho-Maklai, A. D., Novye dannye o faune Foraminifera iz permskikh otlozheni Kavkaza: Akad. Nauk SSSR, Doklady, vol. 58, pp. 269–271. (In Russian, non vidi; no. 292 for the year 1947.)
408. Miklukho-Maklai, A. D., K faune Foraminifer permi Zakavkazya: ibid., vol. 58, pp. 1447–1449. (In Russian, non vidi; no. 293 for the year 1947.)
409. Miklukho-Maklai, A. D., O nakhodke kamennougolnykh otlozheni v Sikhote-Aline: ibid., vol. 58, pp. 1749–1750. (In Russian, non vidi; no. 294 for the year 1947).

1949

410. LeCalvez, Jean, Modofications nucléaires, cycle et sexualité chez les Foraminifères: 13th Cong. Internat. Zool. Paris, Extr., pp. 209–210. (No. 432 for the year 1949).

1950

411. Rozovskaya, S. E., Rod *Triticites*, ego razvitie i stratigraficheskoe znachenie (The genus *Triticites*, its development and stratigraphic significance): Akad. Nauk USSR, Paleont. Inst., Trudy, vol. 26, pp. 1–80, pls. 1–10, 2 text figs., 1 table. (In Russian; no. 513 for the year 1950).

1951

412. Friese, Heinrich, Zur Foraminiferen-Fauna der Meeresmolasse des unteren Inngebietes: Geol. Dienst Berlin, Abhandl., N.F. Heft 227, pp. 1–52, pls. 1–14, 1 text fig. (No. 376 for the year 1951).
413. LeCalvez, Jean, Déréglement du metabolisme ferrugineux chez les Foraminifères: Vie et Milieu, Paris, vol. 2, pp. 335–337. (No. 377 for the year 1951).
414. LeCalvez, Jean, and LeCalvez, Yvonne, Contribution à l'étude des Foraminifères des eaux saumâtres: I. Etangs de Canet et de Salses: Vie et Milieu, Paris Univ., Lab.

Arago, Bull., vol. 2, pp. 237–254, 5 text figs., 2 tables. (No. 378 for the year 1951).

415. MARWICK, J., Dr. H. J. Finlay: Nature (London), vol. 167, no. 4255, pp. 796–797. (No. 379 for the year 1951).

416. PLANAS Y SAINZ, JUAN MANUEL, La vida y la ciencia del profesor Luis M. Rutten: Acad. Cienc. Med., Fis. y Nat. Habana, An. vol. 89, fasc. 1, pp. 17–30. (No. 380 for the year 1951).

417. PUGIN, LOUIS, Les Préalpes médianes entre le Moléson et Gruyères (Préalpes fribourgeoises): Eclog. geol. Helvetiae, vol. 44, no. 2, pp. 207–297, 2 pls., 8 text figs., 2 tables. (No. 381 for the year 1951).

418. SCHAUB, H., Bericht uber die Exkursion der S.G.G.: Luzern-Alpnach-Steinbruch Guber-Grosse Schlieren-Giswil: ibid., vol. 44, no. 2, pp. 364–365. (No. 382 for the year 1951).

419. SCHAUB, H., Bericht uber die Exkursion der S.G.G.: Entlebuch-Glaubenberg-Sarnen: ibid., vol. 44, no. 2, pp. 369–372. (No. 383 for the year 1951).

420. STEAD, FREDERICK L., Foraminifera of the Glen Rose formation (Lower Cretaceous) of central Texas: Texas Jour. Sci., San Marcos, Texas, vol. 3, no. 4, pp. 577–605, 3 pls., 7 text figs. (No. 384 for the year 1951).

421. STEFANI, T. DE, Su alcune manifestazioni di idrocarburi in provincia di Palermo e descrizione di Foraminiferi nuovi: Plinia, vol. 3, nota 4, 12 pp., 9 figs. (No. 385 for the year 1951).

422. STEFANI, T. DE, Alveoline e Flosculine: ibid., vol. 3, nota 5, 7 pp., 9 figs. (No. 386 for the year 1951).

423. TRUMPY, RODOLPHE, Sur les racines hélvétiques et les "Schistes lustrès" entre le Rhône et la Vallée de Bagnes (Region de la Pierre Avoi): Eclog. Geol. Helvetiae, vol. 44, no. 2, pp. 338–347, 1 text fig. (No. 387 for the year 1951).

ADDENDA TO INDEX TO FORAMINIFERA

1943

Textularia informis Montanaro-Gallitelli, Soc. Toscana Sci. Nat., Atti Mem., vol. 52, p. 61. Not figured. Upper Cretaceous, Italy (For: *Textularia bolivinoides* Reuss in: Beissel, 1891, Preuss. Geol. Landes-Anst., Abhandl., N.F. Heft 3, p. 67, pl. 13, figs. 8–13).

Trochammina glomospiroides Montanaro-Gallitelli, ibid., vol. 52, p. 59. Description only; not figured. Upper Cretaceous, Italy.

1947

ROBULAMMINA gen. nov. Montanaro-Gallitelli, ibid., vol. 54, p. 189. Genotype: *Haplophragmoides ? robulus* Montanaro-Gallitelli, 1947, ibid., vol. 54, p. 147, text fig. 1(9–10), and 2(5). New genus of fam. Lituolidae. Upper Cretaceous.

1948

Nummulites acutus (Sowerby, 1837) var. *tuberculata* Doncieux, **362,** p. 20, pl. 5, figs. 10, 11. Middle Eocene (Lutetian), Radama Islands, Madagascar (Preoccupied by *Camerina tuberculata* Bruguière, 1792, Encycl. Méthod., "Vers," vol. 1, p. 400).

1950

Bdelloidina aggregata Carter, 1877, var. *bradii* Elias, Jour. Paleontology, vol. 24, p. 301, pl. 43, figs. 4–6. Recent, Admiralty Islands.

Fusulinella derelicta Saurin, **393,** p. 16, pl. 2, figs. 15–17; pl. 3, figs. 5–8, 11–17, 19, 20. Lower Permian, Indochina.

—— —— var. *minor* Saurin, **393,** p. 17, pl. 3, fig. 10. Lower Permian, Indochina.

Ozawainella pisolithica Saurin, **393,** p. 17, pl. 3, fig. 19. Lower Permian, Indochina.

Protriticites subschwagerinoides Rozovskaya, **411,** p. 9, pl. 1, figs. 5–7. Lower Carboniferous, Soviet Russia.

Reichelina ? kiluensis Saurin, **393,** p. 12, pl. 1, fig. 6. Lower Permian, Indochina.

Schubertella delumbata Saurin, **393,** p. 15, pl. 2, figs. 8, 11, 13, 14; text figs. 1, 2. Lower Permian, Indochina.

Staffella rotundata Saurin, **393,** p. 11, pl. 1, figs. 3–5, 7–9; pl. 3, fig. 1. Lower Permian, Indochina.

Triticites langsonensis Saurin, **393,** p. 23, pl. 4, figs. 1–11, 13–15. Lower Permian, Indochina.

—— (*Jigulites*) *dagmarae* Rozovskaya, **411,** p. 39, pl. 8, figs. 6, 7. Upper Carboniferous, Soviet Russia.

—— (——) *intermedius* Rozovskaya, **411,** p. 40, pl. 9, figs. 1–3. Upper Carboniferous, Soviet Russia.

—— (——) *longus* Rozovskaya, **411,** p. 41, pl. 10, figs. 1, 4. Upper Carboniferous, Soviet Russia.

—— (——) —— subsp. *formosus* Rozovskaya, **411,** p. 42, pl. 10, figs. 2–3, 5–7. Upper Carboniferous, Soviet Russia.

—— (——) *magnus* Rozovskaya, **411,** p. 40, pl. 9, figs. 4–7. Upper Carboniferous, Soviet Russia.

—— (*Montiparus*) *paramontiparus* Rozovskaya, **411,** p. 13, pl. 1, figs. 8–10. Upper Carboniferous, Soviet Russia.

—— (——) —— subsp. *mesopachys* Rozoskaya, **411,** p. 13, pl. 2, figs. 1–3. Upper Carboniferous, Soviet Russia.

—— (——) *reticulatus* Rozovskaya, **411,** p. 19, pl. 4, fig. 1. Upper Carboniferous, Soviet Russia.

—— (——) *rhombiformis* Rozovskaya, **411,** p. 20, pl. 4, figs. 2–4. Upper Carboniferous, Soviet Russia.

—— (——) *sinuosus* Rozovskaya, **411,** p. 18, pl. 3, figs. 6–9. Upper Carboniferous, Soviet Russia.

—— (——) *subcrassulus* Rozovskaya, **411,** p. 17, pl. 3, figs. 1–3. Upper Carboniferous Soviet Russia.

—— (*Rauserites*) *bashkiricus* Rozovskaya, **411,** p. 32, pl. 6, fig. 6. Upper Carboniferous, Soviet Russia.

—— (——) *condensus* Rozovskaya, **411,** p. 36, pl. 7, figs. 9–11. Upper Carboniferous, Soviet Russia.

—— (——) *dictyophorus* Rozovskaya, **411,** p. 34,

pl. 7, figs. 1–5. Upper Carboniferous, Soviet Russia.

—— (——) *karlensis* Rozovskaya, **411,** p. 31, pl. 3, figs. 10, 11. Upper Carboniferous, Soviet Russia.

—— (——) *primitivus* Rozovskaya, **411,** p. 30, pl. 3, figs. 4, 5. Upper Carboniferous, Soviet Russia.

—— (——) *procullomensis* Rozovskaya, **411,** p. 38, pl. 8, figs. 1–5. Upper Carboniferous, Soviet Russia.

—— (——) *variabilis* Rozovskaya, **411,** p. 31, pl 4, figs. 5–11. Upper Carboniferous. Soviet Russia.

—— (*Triticites*) *noinskyi* Rauser-Chernoussova, 1938, subsp. *plicatus* Rozovskaya, **411,** p. 26, pl. 5, figs. 13–16. Upper Carboniferous, Soviet Russia. (Note: cave *Triticites plicatulus* Merchant and Keroher, 1939).

—— (——) *ovalis* Rozovskaya, **411,** p. 21, pl. 3, figs. 12, 13. Upper Carboniferous, Soviet Russia.

—— (——) *paraschwageriniformis* Rozovskaya, **411,** p. 29, pl. 7, fig. 12. Upper Carboniferous Soviet Russia.

—— (——) *parvulus* (Schellwien, 1908) subsp. *ishimbaji* Rozovskaya, **411,** p. 28, pl. 6, figs. 7–9. Upper Carboniferous, Soviet Russia.

—— (——) *schwageriniformis* Rauser-Chernoussova, 1938, subsp. *mosquensis* Rozovskaya, **411,** p. 23, pl. 5, figs. 6–8. Upper Carboniferous, Soviet Russia.

—— (——) —— var. *minor* Rozovskaya, **411,** p. 25, pl. 5, figs. 11, 12. Upper Carboniferous, Soviet Russia.

—— (——) —— subsp. *nanus* Rozovskaya, **411,** p. 24, pl. 5, figs. 9, 10. Upper Carboniferous, Soviet Russia.

—— (——) *shikhanensis* Rozovskaya, **411,** p. 27, pl. 6, figs. 1, 2. Upper Carboniferous, Soviet Russia.

—— (——) —— subsp. *compactus* Rozovskaya, **411,** p. 27, pl. 6, figs. 3–5. Upper Carboniferous, Soviet Russia. (Note: Varietal name preoccupied by *Triticites compactus* White, 1932, Univ. Texas Bull. 3211, p. 38, pl. 2, figs. 10–12; Pennsylvanian, Texas.)

1951

Choffatella stenzeli Stead, **420,** p. 590, pl. 1, figs. 27–30. Lower Cretaceous, (lower Albian) Texas.

Cribrostomoides frizzelli Stead, **420,** p. 588, pl. 1, fig. 4. Lower Cretaceous, (lower Albian), Texas.

Cuneolina trinitensis Stead, **420,** p. 592, pl. 2, figs. 14, 15. Lower Cretaceous, (lower Albian, Texas.

Elphidium littorale J. LeCalvez and Y. LeCalvez, **414,** p. 251, text fig. 5, a, b. Recent, brackish water, southwestern France.

Frondicularia scheffeni Friese, **412,** p. 27, pl. 11, figs. 23, 24. Middle Oligocene, (Rupelian), Lower Bavaria, Germany.

Lagena orbignyana (Sequenza, 1862) subsp. *striata* Friese, **412,** p. 27, pl. 1, fig. 35. Middle Oligocene (Rupelian), Lower Bavaria, Germany. (Note: Varietal name preoccupied by Walker and Boys, 1784, in Brown, 1827, Illustr. Conch. Great Britain, flyleaf, pl. 1, fig. 36. Also by: *Lagena* (*Oolina*) *striata* d'Orbigny, 1839, in Reuss, 1863, and subsequent authors).

Lenticulina subarenacea Stead, **420,** p. 594, pl. 3, fig. 2. Lower Cretaceous (lower Albian), Texas.

Quinqueloculina triangulata Stead, **420,** p. 593, pl. 2, figs. 22–24. Lower Cretaceous (lower Albian), Texas.

Ramulina protea, **420,** p. 596, pl. 3, fig. 10. Lower Cretaceous (lower Albian), Texas. (Note: Preoccupied by *Polymorphina* (now *Ramulina*) *proteus* Beissel, 1891, Preuss, Geol. Landes-Anst., Abhandl., N.F. vol. 3, p. 59, pl. 11, figs. 1–56; pl. 12, figs. 1–6k.

Reussella comalensis Stead, (non *Reusella*), **420,** p. 597, pl. 3, fig. 16. Lower Cretaceous (lower Albian), Texas.

Robulus incisus Lys, 1951, var. *dissimilis* Lys, **199,** p. 96, pl. 2, figs. 11–13. Paleocene, Senegal. (Note: Varietal name preoccupied by *Robulus dissimilis* Bermudez, 1949, Cushman Lab. Foram. Research, Spec. Publ. 25, p. 125, pl. 7 figs. 15, 16; upper Oligocene, Dominican Republic).

Tritaxia glenrosensis Stead, **420,** p. 592, pl. 2, figs. 8–11. Lower Cretaceous (lower Albian), Texas.

Vaginulina rugosa Stead, **420,** p. 595, pl. 3, fig. 7, Lower Cretaceous (lower Albian), Texas. (Note: Preoccupied by Terquem, 1866, Six. Mem. Foram. Lias, p. 497, pl. 20, fig. 34).

Astacolus sp. Stead, **420,** p. 595, pl. 3, figs. 3, 4. Lower Cretaceous, Texas.

Globigerina sp. Stead, **420,** p. 604, pl. 3, figs. 26–28. Lower Cretaceous, Texas.

Lagena sp. Stead, **420,** p. 596, pl. 3, fig. 6. Lower Cretaceous, Texas.

Lenticulina sp. Stead, **420,** p. 595, pl. 3, fig. 1. Lower Cretaceous, Texas.

Lituotuba sp. Stead, **420,** p. 588, pl. 1, fig. 1. Lower Cretaceous, Texas.

Quinqueloculina sp. Stead, **420,** p. 593, pl. 2, figs. 19–21. Lower Cretaceous, Texas.

Ramulina sp. Stead, **420,** p. 596, pl. 3, figs. 11–13. Lower Cretaceous, Texas.

Rotalia sp. Stead, **420,** p. 604, pl. 3, fig. 25. Lower Cretaceous, Texas.

Spiroplectammina sp. Stead, **420,** p. 591, pl. 2, figs. 3, 4. Lower Cretaceous, Texas.

Vaginulina sp. Stead. **420,** p. 595, pl. 3, fig. 8. Lower Cretaceous, Texas.

Verneuilina sp. Stead, **420,** p. 591, pl. 2, fig. 7. Lower Cretaceous, Texas.

JOURNAL OF PALEONTOLOGY, VOL. 26, NO. 6, PP. 993–1000, NOVEMBER 1952

PALEONTOLOGICAL NOTES

SIGNIFICANT COMPARISONS IN PALEONTOLOGY

ROBERT LEE MILLER AND J. MARVIN WELLER
University of Chicago

INTRODUCTION

Almost all taxonomic differentiations of fossils are made upon the basis of measurements—expressed or implied—and counts. Theoretically, there is no limit to the number of such observations that might be made upon a single specimen. There is, however, a very definite practical limit to the number of comparisons that can be made in judging the differences or similarities of specimens. In general practice the observer selects a few characters and measures or counts them because they are obvious or easy to investigate, or because he has a hunch that they are significant, and draws conclusions accordingly.

This rather hit or miss method of comparison is open to serious criticism. Do the chosen characters have biological meaning and, if so, what is it? Might not other characters be more significant? Are the chosen characters related and, if so, are not some of the observations unnecessary? These and other questions that might be asked suggest that more logical and better controlled comparisons are essential if the most significant similarities and differences are to be discovered.

Most biologists will admit on general principles that many characters of organisms are interrelated and that their variations are correlated with each other. If this is so, comparisons of groups of characters should be more meaningful than comparisons of characters considered individually. Probably groups of related characters are interrelated functionally in some way and, therefore, similarities or differences should be of fundamental biological importance. But how can the truth of this supposition be tested with respect to fossils?

Without formal mathematical analysis the establishment of groups of characters is very difficult. Two methods have been developed, however, to accomplish this. With one of them a large number of different characters can be investigated in a qualitative fashion. With the other a smaller number of characters can be studied much more exactly. The method more suitable in a particular inquiry depends, among other things, upon preexisting knowledge of relationships. With many fossils, and particularly extinct groups, the first method, which is discussed below, is preferable because it reveals relationships that may not be at all obvious. If desirable, this can be followed by application of the more precise second method which will be explained in another article.

THE SAMPLE

The relations that may link various characters of an organism cannot be determined from the study of a single specimen. A group of individuals is necessary in order that the variability of the characters can be determined and compared. In accordance with basic statistical principles, these specimens should constitute an unbiased and random sample of a population and be sufficiently numerous to encompass adequately the range of variability that occurs. The sample that was actually used in the demonstration of this method consisted of 50 skulls of the common grey squirrel from Michigan (Miller, 1950). This squirrel possesses no peculiar virtues in connection with such a study but a series of skulls was available, they are of convenient size and desirably complex in structure, and the functional relations of correlated characters could be checked by histological investigations of other specimens as is not possible in the case of fossils.

MEASUREMENTS

After careful study of the skulls, 213 measures were selected and made on each specimen. It is not necessary to list them here or to describe them beyond stating

that they include a variety of linear dimensions of bones and groups of bones, including distances between related areas of muscle attachment and measurements of size and distribution of foramina with respect to each other and the surrounding bones. Thus a complex linear network was set up in terms of which the skull could be very completely described.

STANDARD STATISTICAL TREATMENT

Each of the characters measured is a variable. Each could be analysed and its mean and standard deviation determined. Then pairs could be correlated but this would necessitate 22,578 separate calculations. Even if this were done, significance of the results would be hopelessly lost in an endless mass of figures and still nothing would be determined regarding group relationships. Multiple correlations are possible, but the calculations rapidly pyramid in complexity and would be physically impossible without the use of an electronic calculator. Obviously the handling of any such quantity of data by standard statistical methods is out of the question.

EDGE MARKED CARDS

An ingenious simple system has been devised by Thurston (1948) to analyse large bodies of statistical data qualitatively. This consists of the preparation of cards, one for each specimen, which are marked at similar places along their margins for each character. The marks, in two different colors, show whether the measure of each character of each specimen falls above or below the mean value of this character for the entire sample. Crude correlations can be made easily by first sorting the cards into two groups according to the color mark- for any particular character. Then each group of cards is fanned out and the proportion of colors for each other character is noted. The degrees of correlation are roughly indicated by the ratios of the predominant color to the total number of cards (both groups).

Mathematical analysis of this method shows that ratios of .60 or more indicate significant correlation (Miller, 1950, pp. 27–29). If the color of the compared character is similar to the color of the character on whose basis the cards were sorted, the correlation is positive; if it is the opposite color the correlation is negative.

This method satisfactorily indicates correlations between pairs of characters and suggests the composition of groups of interrelated characters but further investigation is necessary to determine these groups with reasonable certainty.

GROUPED CHARACTERS

In order to investigate the grouping of interrelated characters an individual character is chosen which seems to be highly correlated with several other characters. The importance of this choice is not great as it only aids in setting up a hypothetical group to be tested. Any number of such choices can be made.

The cards are separated into two color groups on the basis of the chosen character and a record made of other characters which show 60 percent agreement or disagreement. Then the cards are sorted on the basis of each of these characters in turn and the results are tabulated. The accompanying table shows such an arrangement actually made during the study of the squirrel skulls. Ratios are expressed in fractions showing the number of cards in agreement or disagreement (disagreement is indicated by a − sign) in the numerator and the number of specimens in the denominator. Notice that imperfections prevented the making of some measurements and consequently a few of the denominators are less than 50.

Further operations are indicated on the table. First, all entries with values below .60 are crossed off (/). The number of rejections is entered in the "No. rejected" column. Notice that these rejections include entries in both the horizontal row opposite the letter identifying a character and in the vertical column beneath this same letter.

The number of rejections is a rough indication of the correlation existing between each character and the hypothetical group. If the rejections are 50 percent or more (6 or more in the example) this character is eliminated from the group (crossed out with horizontal and vertical lines in table). The remaining rejections are entered in the "2nd count" column and the process of elim-

TABLE 1.—METHOD OF DETERMINING GROUPED CHARACTERS

2'nd count	No. rejected	Measurement symbol	(92) A	C	D	E	F	G	H	I	J	K	L	M
—	8	(2) B	-34/50	25/50	28/50	30/50	-26/50	25/50	37/50	34/50	26/48	33/50	25/50	37/50
0	4	(5) C	32/50		30/50	30/50	30/50	-26/50	36/50	32/50	28/48	37/50	30/50	30/50
—	7	(28) D	-32/50			28/50	32/50	27/50	29/50	33/50	-26/48	29/50	25/50	31/50
1	4	(36) E	-32/50				28/50	-30/50	31/50	35/50	27/50	35/50	27/50	31/50
1	5	(69) F	-34/50					25/50	33/50	33/50	-31/50	31/50	27/50	27/50
—	9	(87) G	32/50						26/50	-29/50	28/47	26/48	28/50	27/50
0	5	(114) H	-31/50							32/50	26/48	26/50	32/50	32/50
0	2	(119) I	31/50								28/48	36/50	32/50	32/50
—	9	(173) J	32/50									25/50	29/50	34/50
—	6	(189) K	-33/50										28/50	30/50
—	7	(220) L	31/50											32/50
1	4	(230) M	-31/50											

ination continued if necessary. In the example of the squirrel skulls further rejection and a third count were not required. The likelihood of additional rejections increases in proportion to the number of characters originally included in the hypothetical group.

SIGNIFICANCE OF GROUPS

After the final necessary rejections, the remaining characters constitute what appears to be a highly intercorrelated or interrelated group. In the study of the squirrel skulls approximately 60 percent of the 213 characters was found to belong in one or another of 7 groups. In addition 24 characters were included in 2 groups, 17 characters in 3 groups and 6 characters in 4 groups. Sixteen characters rejected on first counts of the hypothetical groups were not included in any other group.

Inspection of the groups of skull characters clearly showed that each is localized in some way or is probably functional. This observation and the conclusion that these groups have real biological significance is considered to be one of the most important results of the skull study.

FURTHER ANALYSIS

The crude method of analysis described furnishes a reasonable first approximation of morphological order. If further study is desirable standard statistical procedures are available.

Factor analysis might further restrict the characters constituting a group. To conduct such a study the fractions in the group table must be replaced with conventional coefficients of correlation values.

Significant results might be produced by factor analysis of characters common to two or more groups.

Further consideration of poorly correlated characters and characters not included in any hypothetical group might be important. Such characters are interesting because they may be statistically independent. If so, they could not be omitted from any complete biometric analysis. Perhaps they might be particularly significant phylogenetically.

CHOICE OF CHARACTERS FOR COMPARISON

This rapid method of analysis of large bodies of quantitative data should be very useful in selecting a small number of highly significant characters for routine comparison in taxonomic work. As described, groups of interrelated characters can be determined, and commonly a single character can be selected as the representative of each group. These, and possibly a few apparently important independent characters would form the basis for comparison. An adequate study of a single sampled population would produce the basic data applicable to a more or less extensive assemblage of related or similar populations. Differences in the composition of functional groups in different populations should not be overlooked, however, because almost certainly this would be biologically important.

REFERENCES

THURSTON, L. L., 1948, Edge marking method of analyzing data: Jour. Amer. Statist. Assoc., vol. 43, pp. 451–457.

MILLER, R. L., 1950, Biometrical analysis of skull morphology: unpublished thesis, Univ. of Chicago.

A LOWER DEVONIAN *PTERYGOTUS* FROM WYOMING

ERIK N. KJELLESVIG-WAERING
Helmerich and Payne, Inc., Tulsa, Oklahoma
AND
LEIF STØRMER
University of Oslo, Oslo, Norway

The Devonian of North America, unlike Britain, has yielded only scattered and fragmentary remains of the genus *Pterygotus*. The described forms include *Pterygotus atlanticus* Clarke and Ruedemann (1912, p. 356) from the Middle Devonian Gaspé sandstone at Campbellton, New Brunswick; *P.* cf. *P. atlanticus* recorded by Russell (1947, p. 3) also in the Gaspé sandstone at Gaspé, Quebec; *P. elleri* Ruedemann (1935, p. 71) from the Upper Devonian "Chemung" beds at Alfred Station, New York; and *P. montanensis* Ruedemann (1935, p. 72) from the Upper Devonian Three Forks shale at Three Forks, Montana. Indeterminable fragments (Clarke and Ruedemann 1912, p. 356, and O'Connell 1916, p. 23) have been reported from the Lower Devonian Grand Greve limestone and the Middle Devonian Gaspé sandstones of the Gaspé Peninsula; the Lower Devonian Dalhousie beds at Dalhousie, New Brunswick; and the Lower Devonian Knoydart formation at Arisaig, Nova Scotia.

The genus *Pterygotus* is, however, well represented in Ordovician and Silurian beds of North America; greatest development occurs in the Silurian, and by far the greatest number of specimens are from New York. All forms, however, are restricted to eastern North America with the exception of *Pterygotus montanensis* of Montana. The presence of a *Pterygotus* in the Lower Devonian fish-beds of Beartooth Butte, Wyoming is, therefore, an important addition to our meager knowledge of the genus in Devonian time.

In a previous note (Kjellesvig-Waering and Størmer, 1952, p. 659) it was demonstrated that a telson and part of a tergite of a large *Pterygotus* had been erroneously referred to *Strobilopterus princetonii* by Ruedemann (1934, p. 166) inasmuch as the chelicera of that form was then unknown. There is no doubt that the two large fragments represent a new *Pterygotus* which has been named in honor of Dr. B. F. Howell of Princeton University whom the writers wish to thank for the loan of the specimens described in these notes.

Class MEROSTOMATA Woodward
Subclass EURYPTERIDA (Burmeister)
Order EURYPTERIDA Burmeister
Superfamily EURYPTERIDACEA Størmer
Family PTERYGOTIDAE Clarke and Ruedemann
Genus PTERYGOTUS Agassiz, 1839
PTERYGOTUS (PTERYGOTUS) HOWELLI Kjellesvig-Waering and Størmer, n. sp.
Text-fig. 1

Gen. and spec. indet. (scaled fish) BRYANT, 1934, Proc. Amer. Philos. Soc., vol. 13, p. 151, pl. 21.
Pterygotus princetonii RUEDEMANN (in part only), 1934, Proc. Amer. Philos. Soc., vol. 73, p. 166, pl. 2.
Strobilopterus princetonii RUEDEMANN (in part only), 1935, Proc. Amer. Philos. Soc., vol. 75, pl. 3.
Strobilopterus princetonii RUEDEMANN (in part only), 1939, Type invertebrate fossils of North America (Devonian): Wagner Free Inst. Sci., Eurypterida, 13a, b, fig. 3.

The telson is preserved as an uncrushed impression, possibly the dorsal side, retaining convexity and including the posterior part of the structure. The lateral margins reach their greatest divergence nearly at the posterior angles which are rounded and bent downwards. The posterior margins are nearly straight and meet at midsection in a broad, flat, terminal spine. The lateral and posterior margins are bounded by coarse, rounded, knob-like scales which become greatly diminished in size at the edges of the terminal spine. No trace of dorsal carina present. Greatest width of telson is 128 mm.; the terminal spine measures 39 mm. in width and 21 mm. in length at the level of emergence.

A distorted tergite, very likely represent-

ing the dorsal part of a mesosomatic segment, reveals typical pterygotid type of scales. The anterior part of the tergite reveals scattered linear scales which become semilunar in shape and crowded over the greater part of the fragment. The largest of these semilunar scales measures 7 mm. in width. The entire fragment measures 61 mm. in length and 124 mm. in width.

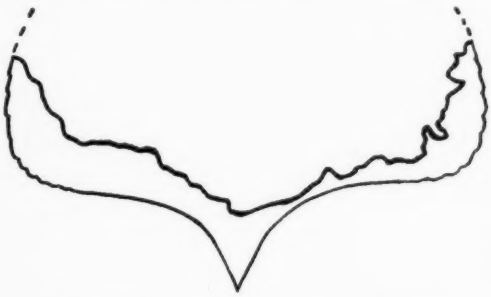


FIG. *1*—Telson of *Pterygotus howelli*, ×½.

These are incomplete measurements of the tergite, and indicate an eurypterid comparable in size to the telson above described.

Remarks.—A triangular terminal spine of the telson is found in typical species of the subgenus *Pterygotus*. The Devonian *Pterygotus* (*Pterygotus*) *anglicus* Agassiz (Woodward, 1866–78, pl. 6) and the Silurian *P.* (*P.*) *cobbi barrandei* Semper (Prantl and Přibyl, 1948, fig. 9) have a less prominent terminal spine. The large and broad terminal spine of the telson in *P.* (*P.*) *howelli* seems therefore sufficient to distinguish this form as a separate species.

Horizon and locality.—Associated with land plants, ostracoderms, sharks, and arthrodires (Bryant, 1934, p. 111), *Eurypterus latus* Ruedemann, and *Strobilopterus princetonii* (Ruedemann) in dolomitic limestone of Lower Devonian age. The deposits represent a lens which had filled a channel. Beartooth Butte, Wyoming.

Depository.—The telson, considered the holotype, is registered as No. 13740 and counterpart, No. 13740b; the tergite is No. 13661. Both specimens are in the Geological Museum, Princeton University.

REFERENCES

BRYANT, W. L., 1934, *Crytaspis* and other Lower Devonian fossil fishes from Beartooth Butte, Wyoming: Proc. Amer. Philos. Soc., vol. 75, pp. 111–128, 18 pls.

CLARKE, J. M., and RUEDEMANN, R., 1912, The Eurypterida of New York: N. Y. State Mus., Mem. 14, 439 pp., 88 pls., 121 figs.

O'CONNELL, M., 1916, The habitat of the Eurypterida: Bull., Buffalo Soc. Nat. Sci., vol. 11, 277 pp., 28 figs.

KJELLESVIG-WAERING, E. N., and STØRMER, L., 1952, The *Dolichopterus-Strobilopterus* group in the Eurypterida: Jour. Paleontology, vol. 26, pp. 659–661, 2 figs.

PRANTL, F., AND PŘIBYL, A., 1948, Revision of the Bohemian Silurian Eurypterida: Rozpravy Stat. Geol. Ustava. Republ. Ceskoslov., Svazek 10, 116 pp., 8 pls., 30 text-figs.

RUEDEMANN, R., 1934, Eurypterids from the Lower Devonian of Beartooth Butte, Wyoming: Proc., Amer. Philos. Soc., vol. 13, pp. 163–167, 3 pls. 2 figs.

——, 1935, The eurypterids of Beartooth Butte, Wyoming: Proc., Amer. Philos., vol.75, pp. 129–141, 4 pls., 12 figs.

——, 1935, A review of the eurypterid rami of the genus *Pterygotus* with descriptions of two new Devonian species: Carnegie Mus., Annals, vol. 24, serial 164, art. 6, pp. 69–72, 1 pl., 2 figs.

——, 1939, Type invertebrate fossils of North America (Devonian). Eurypterida: Wagner Free Inst. Sci.

RUSSELL, L. S., 1947, A new locality for fossil fishes and eurypterids in the Middle Devonian of Gaspé, Quebec: Royal Ontario Mus. Pal. Contr. 12, 4 pp.

WOODWARD, H., 1866–1878, Monograph of the British Crustacea belonging to the Order Merostomata: Paleontograph. Soc.

TAXONOMY IN THE JOURNAL OF PALEONTOLOGY

CARL C. BRANSON
Norman, Oklahoma

Paleontologists, perhaps even to a greater extent than zoologists and botanists, are forced to spend a considerable proportion of their time and effort on problems of taxonomy. Much space in paleontologic journals is devoted to discussion of taxonomic problems; space which otherwise could be used for more biologic papers. It should be the goal of each author of a new name to eliminate uncertainty in taxonomy at the souce. The Journal of Paleontology is possibly the publication medium in which more new paleobiological names appear than any other, and it should set a good example to other journals. I find that in the latest number published (volume 24, number 4, July 1952) there are a large number of taxonomic troubles, most of which could have been avoided. Perhaps there are no more in proportion than in earlier numbers, but I select the latest one available for analysis.

It seems to me that the most inexcusable source of trouble in taxonomy is the failure of authors of new names to give the derivation of those names. In many cases of such failure, the reader and the subsequent reviser are in doubt as to correctness of spelling, as to gender, and they are in all too many instances confronted with a meaningless word. That skilled taxonomist, G. Winston Sinclair, has given an amusing illustration of the paleontologist's uncertainty as to the correct spelling where the original author has failed to give the etymology of his new name (Journal of Paleontology, vol. 25, pp. 411–412, 1951). The generic name *Palaeaneilo* Hall has been emended by authors to *Palaeoneilo* on the ground that the original spelling was a typographical error. Sinclair advances the theory that the apparent prefix *palaeo* was actually intended to be *palaea* as it is an anagram for Aleapa, the name of Hall's pet spaniel. Who is to be sure in such cases if the author does not tell us the source of his name?

I find in the July Journal few etymologies and even fewer formal ones, and I hope that the authors will not be offended by my using their papers to illustrate our bad habit of omitting such etymologies. The new specific name *Lithothamnion limaensum* is given without etymology (p. 538). Presumably the species is named for the city of Lima, but in that case the specific name should be *limaense*. On the same page, the new specific name *Lithothamnion wallisium* appears. There is again no etymology, but referring to the introduction we find that the collector of the material is W. E. Wallis. If paleobotanical nomenclature is at all like paleobiological nomenclature, the specific name must be *wallisi*. One of the few etymologies in the entire number of the Journal is under the new name *Mesophyllum pueranum* (p. 539). It states "Named for the Peruvian province containing the type locality." Turning back to the introduction we find the locality is in the Department of Piura. For lack of other evidence, we must assume that the specific name must be emended to *piuranum*.

In the second paper I find but one etymology for the four new generic and 21 new specific names, although most of them are of obvious origin. The new specific name *Cradeocrinus warreni* (p. 551) appears to honor P. S. Warren, but it might be T. E. Warren, W. C. Warren, or, since no Warren appears in the acknowledgments, perhaps the camp cook was Joe Warren, and he happened to find the type specimen. A man is not honored if he is not identified. The new generic name *Ramulocrinus* is given without etymology (p. 557). I find the Latin diminutive ramulus, meaning twig, in my dictionary. Did the authors combine this Latin word with the Greek *κρινον*? Is there a local geographic feature named Ramula Peak or a collector named Ramul? I am forced to refer to the acknowledgments to find that the specific name *kuenzii* (p. 572) is properly rendered, since it is derived from the patronymic Kuenzi, but the reader should not have to search for the derivation.

A paper on Devonian fossils has 17 new specific names, not one accompanied by an etymology. It would seem that *carya* (p. 599) is from the Greek word for nut, but the author may have a friend named Cary. I can

guess, laboriously, that the new specific name *hiraethlynae* (p. 605) is compounded from a form of ἱερος, pertaining to the gods, plus some derivative of ἀολον, a reward, and I suspect that since the specimens came from cores of an oil well, the author is punning in referring to a gift of the gods. The last specific name in the paper is *Chonopectus horaeus*, a new specific name, no derivation given. It might have been formed from Greek ὁραω, to see, or from Latin horae, dial of a clock, or from Greek ὥρη, beauty, or from Greek ὅρος, margin, or from Greek or Latin Ὧραι or Horae, goddesses of the seasons. This case illustrates the confusion caused by omission of etymology when the name is formed from Greek words which may or may not be aspirated and which may be spelled with omicron or omega. Meaning, spelling, and gender are all in doubt.

The new generic name *Isalaux* (p. 641) appears without etymology. I strongly suspect that there has been consistent inversion in the paper and that the name is from Greek ἰσος, equal, and aulax, a furrow. The name, in that case, is *Isaulax*, and the typographical error should be corrected. The new generic name *Velicucullus* (p. 669) appears to derive from Latin velum, a sail, and cucullus, a hood, and is correctly formed. Yet, why should the author force the reader to search for the derivation? Jaeger, in his handsome and useful little book (A source-book of biological names and terms, second edition, 1950) emphasizes the point I am making in his dedication, here quoted in part: "To David Starr Jordan, who had the good sense, when coining generic names, to explain their origin so that those who followed him could have no doubt concerning their exact connotation."

An author is entitled under the rules to use bad judgment in creating his new names, such as in making inordinately long names, in combining Greek and Latin words, in punning, and in giving meaningless or misleading names, but he should not introduce confusion nor should he waste the time of his readers by omitting an explanation of the source of each of his new names.

I propose that it be made a rule of the Society that the editors publish no paper with new names unless all such names in that paper are accompanied by full explanation of their derivation.

EDITOR'S NOTE.—Editors representing both societies agree, in principle, with Dr. Branson's suggestion, and urge all authors to follow the sound taxonomic procedure he recommends. However, until this is incorporated into a revised version of "Style, form, and procedure for the Journal of Paleontology" (Journal of Paleontology, vol. 25, 1951, pp. 709–712), publication of a manuscript whch fails to include derivation of new names introduced therein will not be refused.

JOURNAL OF PALEONTOLOGY, VOL. 26, NO. 6, P. 1001, NOVEMBER 1952

SOCIETY RECORDS AND ACTIVITIES

SOCIETY COMMITTEE APPOINTMENTS

During 1952, President Church has made and received acceptance of these appointments:

M. B. STEPHENSON. Chairman of Program Committee for Society of Economic Paleontologists and Mineralogists Annual Meeting, Houston, Texas, March 23–26, 1953.

JOSEPH F. ROMINGER. Member and vice chairman of Research Committee, consisting of H. W. Menarch, Chairman, E. C. Dapples, G. E. Murray, F. W. Rolshausen, and Joseph F. Rominger.

M. K. ELIAS. Society of Economic Paleontologists and Mineralogists' representative to the International Geological Congress in Algiers, September, 1953.

J. HARLAN JOHNSON and JOHN E. ADAMS. Society of Economic Paleontologists and Mineralogists' representatives on the Committee on Radioactive Mineral Exploration.

JOURNAL OF PALEONTOLOGY, VOL. 26, NO. 6, PP. 1002–1004, NOVEMBER 1952

NOTICES

ANNOUNCEMENT OF JOINT ANNUAL MEETING SAM HOUSTON COLISEUM, HOUSTON, TEXAS, MARCH 23–26, 1953

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS
SOCIETY OF ECONOMIC PALEONTOLOGISTS AND MINERALOGISTS
SOCIETY OF EXPLORATION GEOPHYSICISTS

The joint annual meeting of the three petroleum exploratory societies will be held at the Sam Houston Coliseum, Houston, Texas, on March 23, 24, 25 and 26, 1953.

All requests for hotel rooms should be made by returning the attached form to the A.A.P.G. HOTEL AND HOUSING COMMITTEE, ATTN.: OLIN G. BELL, CHAIRMAN, POST OFFICE BOX 2180, ROOM 955½, HUMBLE BUILDING, HOUSTON 1, TEXAS.

Requests for reservations should be made as far in advance of February 23, 1953 as possible, and should contain all information requested on the attached form. Receipt of requests will be acknowledged and filled in order of receipt by the Hotel and Housing Committee. Actual assignments will be made in the various hotels and confirmations will be mailed about 60 days prior to the convention. Members who request reservations, but later find they can not attend should notify the Hotel and Housing Committee without delay. Blocks of rooms will not be reserved. All rooms must be reserved in the names of individuals.

This notice is being mailed simultaneously to the members of the three societies. Officers, chairmen, and committee members, particularly, are requested to reply promptly.

THE EXECUTIVE COMMITTEES
Tulsa, Oklahoma October 1, 1952

APPLICATION FOR HOUSING ACCOMMODATIONS HOUSTON, TEXAS

For your convenience in making hotel reservations for the coming joint meeting of the American Association of Petroleum Geologists, the Society of Economic Paleontologists and Mineralogists, and the Society of Exploration Geophysicists, March 23–26, 1953, in Houston, hotels and their rates are listed below.

Hotel space in first-class downtown hotels is limited in Houston. There are, however, several good hotels downtown and several first-class semi-residential type hotels out from the center of town in which accommodations have been blocked for this meeting. In addition, there are some excellent motels and tourist courts located on or immediately adjacent to the principal highways in Houston in which space has been reserved. Space for convention members has also been reserved in two excellent hotels in Galveston. A four-lane super highway makes Galveston easily accessible for the convention. Special buses for convention members will be available at the time, or those preferring to use their cars may do so. The distance is fifty miles and can be made with ease and safety in one hour.

In requesting reservations use the form at the bottom of the next page, indicating your first, second, and third choices. Because of the limited number of single rooms available, you will stand a much better chance of securing accommodations if your request calls for rooms to be occupied by two or more persons. All reservations must be cleared through the A.A.P.G. Hotel and Housing Committee. ALL REQUESTS FOR RESERVATIONS MUST GIVE DEFINITE DATE AND HOUR OF ARRIVAL AS WELL AS DEFINITE DATE AND APPROXIMATE HOUR OF DEPARTURE; ALSO NAMES AND ADDRESSES OF ALL PERSONS WHO WILL OCCUPY RESERVATIONS *MUST* BE INCLUDED.

	Single One Person	*For Two Persons Double Bed*	*Twin Beds*	*Suites*
*Rice	$4.50– 8.50	$6.50–10.50	$8.00–11.00	$16.00–up
*Lamar	4.00– 8.00	6.00–10.00	7.50–12.00	14.00–28.00
*Texas State	4.00– 9.00	6.00–12.00	7.00–12.00	9.50–up
*Sam Houston	3.35– 4.00	4.50– 5.50	6.00– 8.00	
*Wm. Penn	3.75– 5.00	5.00– 6.25	7.00	
*Ben Milam	3.75– 5.00	4.00– 5.00	7.00– 9.00	15.50–up
Shamrock	6.00–16.00	8.00–18.00	8.00–18.00	25.00–55.00
Other Good Houston Hotels	2.50– 6.00	3.75– 8.00	6.00– 9.00	8.00–up
Galveston:				
**Galvez	3.50–10.00	5.75– 8.00	6.50– 9.25	12.50–35.00
**Buccaneer	3.50–10.00	5.75– 8.00	6.50– 9.25	12.50–35.00
Motels: Houston	3.00– 6.00	5.00– 8.00	6.00–10.00	10.00–up

* Downtown Hotel.
** On Seawall.

In the event that the hotel room rate structure is changed prior to the above convention, these rates will be changed accordingly.

CUT OFF AND RETURN BELOW THIS LINE

ALL REQUESTS FOR RESERVATIONS MUST BE RECEIVED PRIOR TO FEBRUARY 23, 1953

A.A.P.G. Hotel and Housing Committee
Attn: Olin G. Bell, Chairman
Post Office Box 2180, Room 955½, Humble Building
Houston 1, Texas

Please reserve the following accommodations for the Joint Convention of the A.A.P.G., S.E.P.M., and S.E.G., in Houston, Texas, on March 23–26, 1953.

Single Room _____ Double Bedded Room _____ Twin Bedded Room _____
2 Room Suite _____ Other Type of Room _____
Rate: From $_____ to $_____

First Choice Hotel _____
Second Choice Hotel _____
Third Choice Hotel _____
Motel in Houston _____
Hotel in Galveston _____

Arriving at Hotel (date) _____ Hour _____ A.M. _____ P.M. _____
Leaving (date) _____ Hour _____ A.M. _____ P.M. _____
I (will) (will not) have the use of a car while in Houston.
THE NAME OF EACH HOTEL GUEST MUST BE LISTED. Therefore, please include the names and addresses of all persons for whom you are requesting reservations and who will occupy the rooms asked for: _____

(Please include also the names of both persons for each double room or twin bedded room requested.)
(Individual Requesting Reservations)
Name _____
Address _____
_____
Company Affiliation _____
Would you be interested in attending an Alumni Luncheon? _____
What School? _____

If the hotels of your choice are unable to accept your reservation, the Hotel and Housing Committee will make as good a reservation as possible elsewhere provided that all hotel rooms available have not already been taken.

S.E.P.M. ANNUAL MEETING

THE CORRAL, HOUSTON
March 23–26, 1953

The annual meeting of the S.E.P.M. will be held at The Corral, Houston, Texas, on March 23, 24, 25, and 26, in connection with the meetings of the A.A.P.G. and S.E.G.

Joint sessions with the other two societies are planned for the presidential addresses and for discussion of exploratory techniques. There will be two full days of separate technical sessions for the S.E.P.M., including the symposium, which is entitled "Finding Ancient Shorelines." A field trip is being organized to some of the highly fossiliferous localities in the area.

President Clifford Church has appointed M. B. Stephenson, Stanolind Oil and Gas Company, Box 3092, Houston 1, Texas, program chairman for the S.E.P.M. The membership is invited to participate in the technical program.

THE McLEAN CARD CATALOGUE OF AMERICAN FORAMINIFERA

Subscriptions now being received for volume III—

Volume III (Units 17 through 24) 1953, subscription price $36.00

Subscribers save 10% of cost of volume; single units are $5.00 per unit.

Still available—

Volume I (Units 1 through 8), per volume $40.00

Volume II (Units 9 through 16 complete*), per volume $40.00

* Units 14, 15 and 16 are ready for distribution at the price of $5.00 per unit; these units have not previously been advertised in this advertisement series.

Please address orders and inquiries to:

James D. McLean, Jr., P. O. Box 916, Alexandria, Virginia, U.S.A.

THE SOCIETY OF ECONOMIC PALEONTOLOGISTS AND MINERALOGISTS

P.O. Box 979, Tulsa 1, Oklahoma

Published *annual volumes* of the S.E.P.M. are available at the following terms.

		Regular Price Per Vol.	Special to Members Per Vol.
JOURNAL OF PALEONTOLOGY:			
Vol. 1 (1927).	Complete in 4 Nos. Reprinted 1948		
	Paper-bound copies	$ 6.00	$ ——
	Cloth-bound copies	6.50	——
Vol. 2 (1928).	Complete in 4 Nos.	8.00	6.00
Vol. 3 (1929).	Only Nos. 1 and 2 Available	4.00	3.00
Vol. 4 (1930).	Only Supplement 1 Available	2.00	1.50
Vols. 5 to 8 (1931-34).	Each Complete in 4 Nos.	8.00	6.00
Vols. 9 to 11 (1935-37).	Each Complete in 8 Nos.	16.00	12.00
Vols. 12 to 19 (1938-45).	Each Complete in 6 Nos.	12.00	9.00
Vol. 20 (1946).	Only Nos. 1, 3, 4, 5, 6 Available	10.00	7.50
Vols. 21 & 22 (1947-48).	Each complete in 6 Nos.	12.00	9.00
Vol. 23 (1949).	Only No. 5 Available	2.00	1.50
Vol. 24 (1950).	Only Nos. 2 to 6 Available	10.00	7.50
Vol. 25 (1951).	Only Nos. 2-6 Available	10.00	7.50
Vol. 26 (1952).	Complete in 6 Nos.	12.00	9.00
Vol. 27 (1953).	Non-member, $10.00; Outside U.S., $10.40. Member, Covered by $6.00 dues, postpaid.		
SINGLE ISSUES:	Non-Members, $2.00; Members, $1.50.		
Vol. 26 No. 3 (May 1952).	Non-members, $3.00; Members, $2.50		
JOURNAL OF SEDIMENTARY PETROLOGY:			
Vol. 1 (1931).	Only No. 2 Available	$ 1.75	$ 1.35
Vols. 2 to 7 (1932-37).	Each Complete in 3 Nos.	5.25	4.05
Vol. 9 (1939).	Only No. 1 Available	1.75	1.35
Vol. 17 (1947).	Only Nos. 1 and 2 Available	3.50	2.70
Vol. 18 (1948).	Only Nos. 2 and 3 Available	3.50	2.70
Vol. 19 (1949).	Only No. 3 Available	1.75	1.35
Vols. 20 to 22 (1950-52).	Each Complete in 4 Nos.	7.00	5.40
Vol. 23 (1953).	Non-member, $5.00; Outside U.S. $5.40. Member, Covered by $4.00 dues, postpaid.		
SINGLE ISSUES:	Non-members, $1.75; Members, $1.35.		

BIBLIOGRAPHY OF OTOLITHS, by Robert B. Campbell, 32 pp. (Sept., 1929) ..... $1.00 per copy.

TURBIDITY CURRENTS AND THE TRANSPORTATION OF COARSE SEDIMENTS TO DEEP WATER, A Symposium, 107 pp. (Nov., 1951) ..... Non-members, $2.75 per copy; Members, $2.25 per copy

OFFICERS OF THE SOCIETIES

THE SOCIETY OF ECONOMIC PALEONTOLOGISTS AND MINERALOGISTS

For the year ending March 1953

President, C. C. CHURCH, San Francisco, Calif.

First Past-President, T. H. PHILPOTT, Shreveport, La.

Second Past-President, W. C. KRUMBEIN, Evanston, Ill.

Vice-President, M. B. STEPHENSON, Houston, Tex.

Secretary-Treasurer, C. G. LALICKER, Lawrence, Kan.

Editors

GROVER E. MURRAY and L. J. WILBERT, JR.; Baton Rouge, La., for paleontology.

W. H. TWENHOFEL, Orlando, Fla. (consulting editor) for mineralogy.

JACK L. HOUGH, Urbana, Ill. (editor) for mineralogy.

THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS

For the year ending March 1953

President, M. J. DAVIS, Houston, Tex.

Past-President, FRANK A. MORGAN, Los Angeles, Calif.

Vice-President, J. G. BARTRAM, Tulsa, Okla.

Secretary-Treasurer, John W. Clark, Dallas, Texas.

Editor, KENNETH K. LANDES, Ann Arbor, Mich.

THE PALEONTOLOGICAL SOCIETY

for the year ending November 1953

President, W. STORRS COLE, Ithaca, N. Y.

Vice-President, J. WYATT DURHAM, Berkeley, Calif.

Secretary, KENNETH E. CASTER, Cincinnati, O.

Treasurer, FRANK M. SWARTZ, State College, Pa.

Editor, A. SCOTT WARTHIN, JR. Poughkeepsie, N. Y.

Chairman, Pacific Coast Section, Merton Y. Williams, Vancouver, B. C., Canada.

Ex-Presidents

CHARLES E. WEAVER, Seattle, Wash., 1950.
HAROLD E. VOKES, Baltimore, Md., 1951.
JULIA A. GARDNER, Washington, D. C., 1952

JOINT COMMITTEE ON ZOOLOGICAL NOMENCLATURE FOR PALEONTOLOGY IN AMERICA

Sponsored by the Society of Economic Paleontologists and Mineralogists. The Paleontological Society, and the Society of Vertebrate Paleontology in support of the International Commission on Zoological Nomenclature.

Policy Board

G. WINSTON SINCLAIR, *Chairman* (PS)
R. C. MOORE (PS), BRYAN PATTERSON (SVP)

Members

D. L. FRIZZELL A. MYRA KEEN KATHERINE V. W. PALMER BRYAN PATTERSON	1950–1952
RAYMOND C. MOORE J. BROOKES KNIGHT G. WINSTON SINCLAIR JOHN W. WELLS	1951–1953
S. W. MULLER J. B. REESIDE, JR. BOBB SCHAEFER J. M. WELLER	1952–1954

Address all communications to the chairman, G. WINSTON SINCLAIR, University of Michigan, Ann Arbor, Mich.

THE GEOLOGICAL SOCIETY OF AMERICA

For the year ending November 1952

President, THOMAS S. LOVERING, Denver, Colo.

Vice-Presidents: WENDELL P. WOODRING, CARL O. DUNBAR, HAROLD E. VOKES, ADOLF PABST

Secretary, H. R. ALDRICH, New York, N. Y.

Treasurer, J. EDWARD HOFFMEISTER, Rochester, N. Y.

Councillors

E. F. DAVIS J. HOOVER MACKIN RICHARD J. RUSSELL	1950–1952
RONALD K. DE FORD THEODORE A. LINK WARD C. SMITH	1951–1953
GLENN L. JEPSEN PHILIP B. KING HARRISON SCHMITT	1952–1954
IAN CAMPBELL	1952